HANDLING OF TRANSURANIC WASTE FOR VOLUME REDUCTION BY INCINERATION

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ABSTRACT

The objective of this paper is to describe the material handling systems in the Process Experimental Pilot Plant at Idaho National Engineering Laboratory for treatment and disposal of transuranic waste. These systems are: waste shredding and incineration, off-gas cleaning, and grout preparation and drum fill.

The facility is designed to process seven tons per day of transuranic waste. The selected waste containers are conveyed to a shredder. The waste and containers are shredded and incinerated in a rotary kiln. The cooled solid residue is classified in a trommel screen. The coarse portion is conveyed to a 55-gallon steel drum and the fine portion is conveyed to storage bins. The fines, process sludge containing the combustion chemical contaiminants, and grout are mixed and poured onto the coarse residue in the drum. After curing and inspection, the drums are shipped for disposal at the Waste Isolation Pilot Plant. The combustion gases are cooled and scrubbed with a sodium carbonate solution and passed through a high efficiency particulate air filter before releasing to the atmosphere.

The process design allows for the hands-on maintenance of the combustion gases treatment system, bagout of the filter elements, and elimination of production of additional radioactive liquid waste. The design complies with the EPA, DOE, and State of Idaho environmental regulations on effluent standards.

INTRODUCTION

The purpose of this paper is to describe the design and function of the equipment for volume reduction of transuranic waste in the Process Experimental Pilot Plant (PREPP) at Idaho National Engineering Laboratory (INEL). The technical parameters and process flow diagram of PREPP were discussed in a previous paper.[1] The purpose of PREPP is to demonstrate the feasibility of constructing a full scale plant for treating transuranic contaminated solid waste into a form acceptable for disposal at the proposed Waste Isolation Pilot Plant (WIPP).[2] PREPP is designed to process a maximum of 7 tpd of transuranic waste.[2,3] As of February 1986, the PREPP construction is complete and the system operational testing has begun prior to the waste processing.

The volume reduction process consists mainly of waste shredding and incineration, off-gas cleaning, and grout preparation and drum fill operations.[1-3] The non-shreddable materials are repackaged and returned to Stored Waste Examination Pilot Plant (SWEPP). The cemented waste produced at 8.5 tpd is stored in steel drums at SWEPP for eventual disposal at WIPP. The process off-gas is cleaned prior to its discharge to the atmosphere. There is no generation of liquid waste during operation as the process sludge is continuously encapsulated with the residue of the incinerated waste. The off-gas released to the atmosphere complies with the effluent standards of the State of Idaho, EPA, and DOE.

GENERAL BASIS OF DESIGN

The design is based on the latest applicable codes and standards required by various U.S. societies and associations and by INEL-DOE site standards governing building, equipment manufacturing and installation, personnel safety, and gas effluent. The equipment is generally made of carbon steel, unless otherwise specified, for a minimum of 10 years service life.[3]

PREPP is located in the existing North machine shop in TAN-607 building at INEL.[3] The facility is 4800 ft above sea level with the temperature varying between 70 and 105°F. PREPP will operate 3 shifts per day, 5 days per week, 40 weeks per year, and with no more than 12 weeks per year reserved for facility upgrade and repair and maintenance of equipment. The design allows for the hands-on maintenance of equipment and bagout of the filter elements. The facility incorporates provisions for any future modifications and/or expansions.

The waste is shipped from SWEPP to PREPP on a flatbed truck in 30, 55, 83 gallon carbon steel drums (800, 1075, 800 lb respectively), 4' h x 4' w x 7' l fiberglass coated plywood boxes (5600 lb), and 7' h x 4' w x 5' l carbon steel bins (2825 lb). The cemented waste and unshreddable items are shipped in separate 55 gallon drums from PREPP to SWEPP on the flatbed truck. The waste containers are loaded on and unloaded off the truck by forklifts.

The shredder, conveyors, incinerator, cooling, separating, and concreting equipment are enclosed in a glove box train. The glove boxes are equipped with transfer ports and interconnected via airlocks. The PREPP equipment is interlocked with no redundancy, operates with minimum automation, and is provided with manual overrides on most automatic systems.[2]

PREPP is designed to process a maximum of 7 tpd of average transuranic waste including container weights, 4100 acfm of combustion gases and volume reduction from 17:1 to 2:1.[1] The design has the capabilities of processing transuranic waste with varied physical and chemical properties. The selected

waste is classified into four categories: average waste (40% inorganic sludge, 60% non-sludge), shreddable metals, combustibles, and inorganic sludge. The range of ultimate analyses (%w) for these wastes is: C = 3.24 - 41.81, H = 0.59 - 5.41, O = 6.65 - 34.55, N = 0.05 - 1.02, S = 0.03 - 0.15, Cl = 0.06 - 0.36, Pb = 0.00 - 5.50, Moisture = 0.00 - 48.84, and inerts = 16.47 - 75.32.[3]

PROCESS DESCRIPTION

The general layout of equipment and flow of transuranic waste in PREPP facility are shown in Figs. 1 to 3. The waste to be treated at PREPP is received from SWEPP in shreddable steel drums and bins and fiberglass coated plywood boxes. The waste consists mainly of wood, paper, clothes, plastics, rubber, metals, concrete, glass, sludge, tools, and pipes.

The waste and its container are shredded, then fed to a rotary kiln incinerator heated to 1700°F. The non-shreddable materials are repackaged and returned to SWEPP. The incinerator residue is cooled and classified in a trommel screen. The fine portion is mixed with a sand and cement grout which is placed with the coarse portion in steel drums. After curing, inspection, lidding, decontamination, and labelling, the drums are shipped to SWEPP.

The kiln off-gas is reheated to 2000°F in a secondary combustion chamber to completely burn any remaining hydrocarbons and toxic volatiles.[1] The gases are cooled with aqueous sodium carbonate spray in a quencher. Removal of particulates (99.9%), hydrogen chloride (95%), sulfur oxides (90%), and some nitrogen oxides (35%) from the combustion gases using sodium carbonate solution is accomplished in a venturi scrubber operating at a differential pressure of 50" water gauge (W.G.).

The liquid effluent from the quencher and venturi scrubber is concentrated to 25% solids by a cross flow pressure filter before discharging the slurry into a sludge tank where it is thickened to about 40% solids. The thickened sludge containing the combustion chemical contaminants in the form of liquid waste is encapsulated in a cement concrete with the residue of the incinerated waste.

The venturi scrubber off-gas is passed through mist eliminators to remove residual particulates and any excess moisture. The gas is reheated to about 50°F above the dew point and is passed through a high efficiency particulate air (HEPA) filter prior to its discharge to the atmosphere.[1]

The PREPP operation is closely coordinated with that of SWEPP.[2,3] SWEPP performs the following functions: retrieve stored waste, X-ray and assay, segregate containers, store retrieved waste, store PREPP product, and ship selected stored waste in drums/boxes/bins to PREPP. PREPP performs the following functions:[2,3] shred, incinerate, immobilize by concreting, package product, package unshreddables, verify certification procedures, and ship packaged unshreddable items and drums of encapsulated waste to SWEPP.

WASTE SHREDDING AND INCINERATION SYSTEM

This system, as shown in Fig. 1, consists mainly of a low speed shear shredder, rotary kiln, and secondary combustion chamber (SCC). This equipment is provided with a hydraulic lift, chain conveyors, a monorail equipped with twin hooks, box grab and upender, a horizontal stroke vibratory conveyor, and a kiln feed mechanism. The waste box is unloaded off the flatbed truck and placed on the hydraulic lift. The box is raised and displaced onto a chain conveyor where it is oriented in a vertical position and delivered to the shredder by the monorail. The waste and its container are shredded and transferred to the kiln feed mechanism by the horizontal stroke vibratory conveyor. The shredded waste is fed into a rotary kiln by the incinerator feed mechanism where the waste is incinerated and the combustion gases are further heated with excess air in the SCC. The ash and non-combustibles are removed by gravity flow and collected at the bottom of the SCC.

Shredder

The shredder is a heavy duty low speed industrial unit equipped with two shafts with cutting knives capable of shredding transuranic waste in boxes and drums. The shredder has a shredding rate of 7 tpd of average waste when operating 5 minutes per hour. The shredder is equipped with a primary and secondary grapple. The primary grapple (knuckle boom crane) is a fully automated unit whose main function is lifting the waste container in a vertical position and rotating it across the cutter teeth. This grapple has the capability of exerting downward force on waste containers to force them into the cutter teeth and removing unshreddable items and returning them to the delivery platform. The secondary grapple is a semi-automated unit whose function is to remove too long items from the feed to the incinerator.

Incinerator

The incineration system consists mainly of a sloped rotary kiln (RK) attached to a vertical SCC. The RK and SCC are both refractory lined. The incinerator is provided with a port to interface with the feed mechanism, an ash-inerts discharge chamber interfaced with the ash-inerts discharge conveyors, two burners, liquid injection capability in front of the RK, a combustion blower, steam injection lance ports in the RK, a kiln drive unit, and seals. The RK and SCC burners are respectively modulated 3.5 MBtu/hr and 5 MBtu/hr liquified petroleum gas units.

Rotary Kiln - The nominal size constraints of the RK are 8' od (6' id) by 25' l. The RK is designed to incinerate waste containing a high percentage of non-combustibles and metals in some feed mixes and a high combustibles in others. The nominal feed rate to the RK is 7 tpd (683 lb/hr) of average waste. The RK operates under up to 100%w excess air condition at 1300-1800°F and provides the waste with a retention time up to 90 minutes when the kiln is rotating at 0.3 - 0.5 rpm. The kiln feed mechanism is essentially a scoop equipped to move forward and backward and to turn 360° for hauling the waste and delivering it into the kiln.

The incineration system is designed to operate under slight negative pressure, - 0.5" W.G. maximum. Both ends of the rotating kiln have seals to prevent leakage of air to the incinerator room during normal shutdown or during upset conditions. The primary seal is backed up by a secondary seal. The primary seals are designed to contain a pressure excursion of 5 psi. The secondary seal is designed to contain a pressure excursion greater than 10 psi. A blowout panel is provided in the SCC wall at the outlet end of the kiln and it shall release with a pressure excursion of 10 psi. The incinerator room will be maintained under a negative pressure compared with the rest of the facility. The RK slope is fixed at 0.25"/ft from the

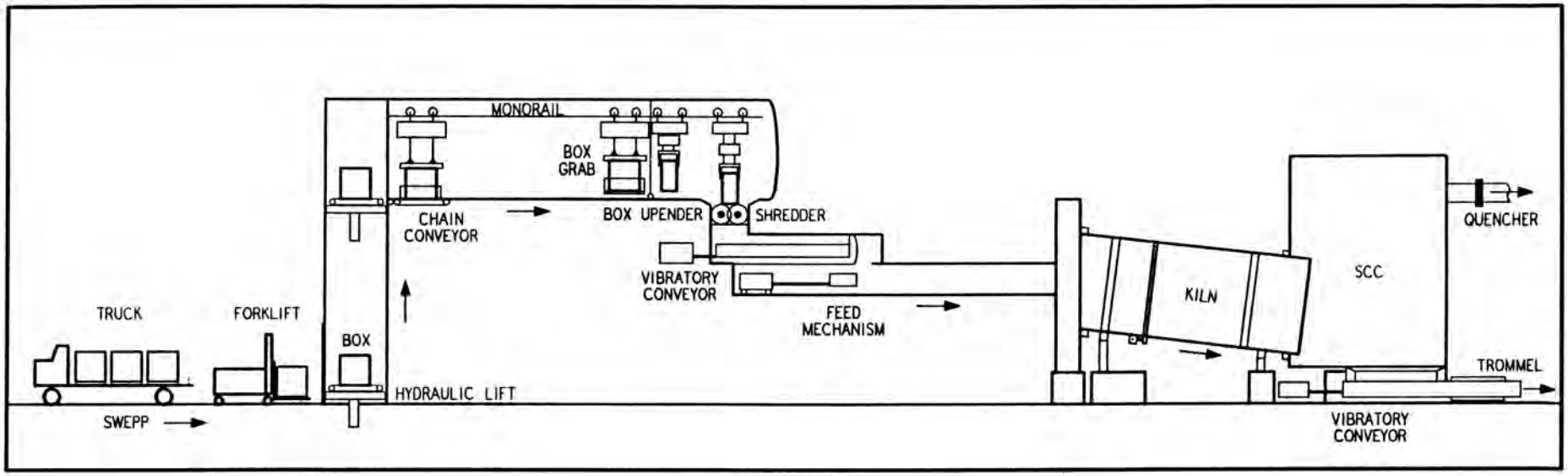

Fig. 1 . PREPP Waste Shredder and Incinerator System.

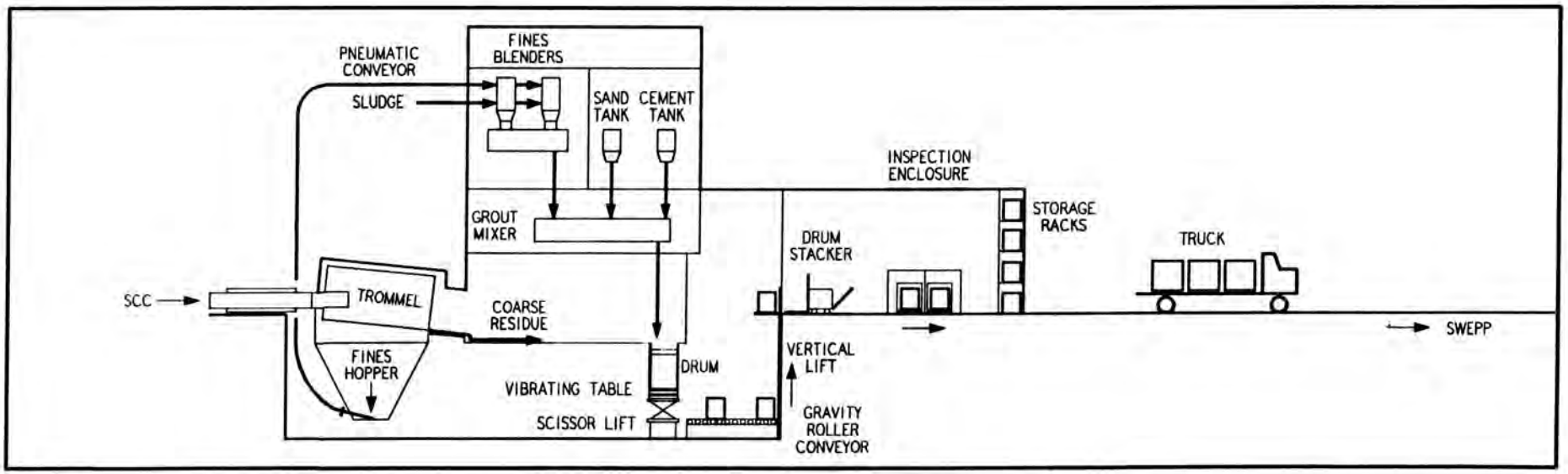

Fig. 2 . PREPP Grout Preparation and Drum Fill System.

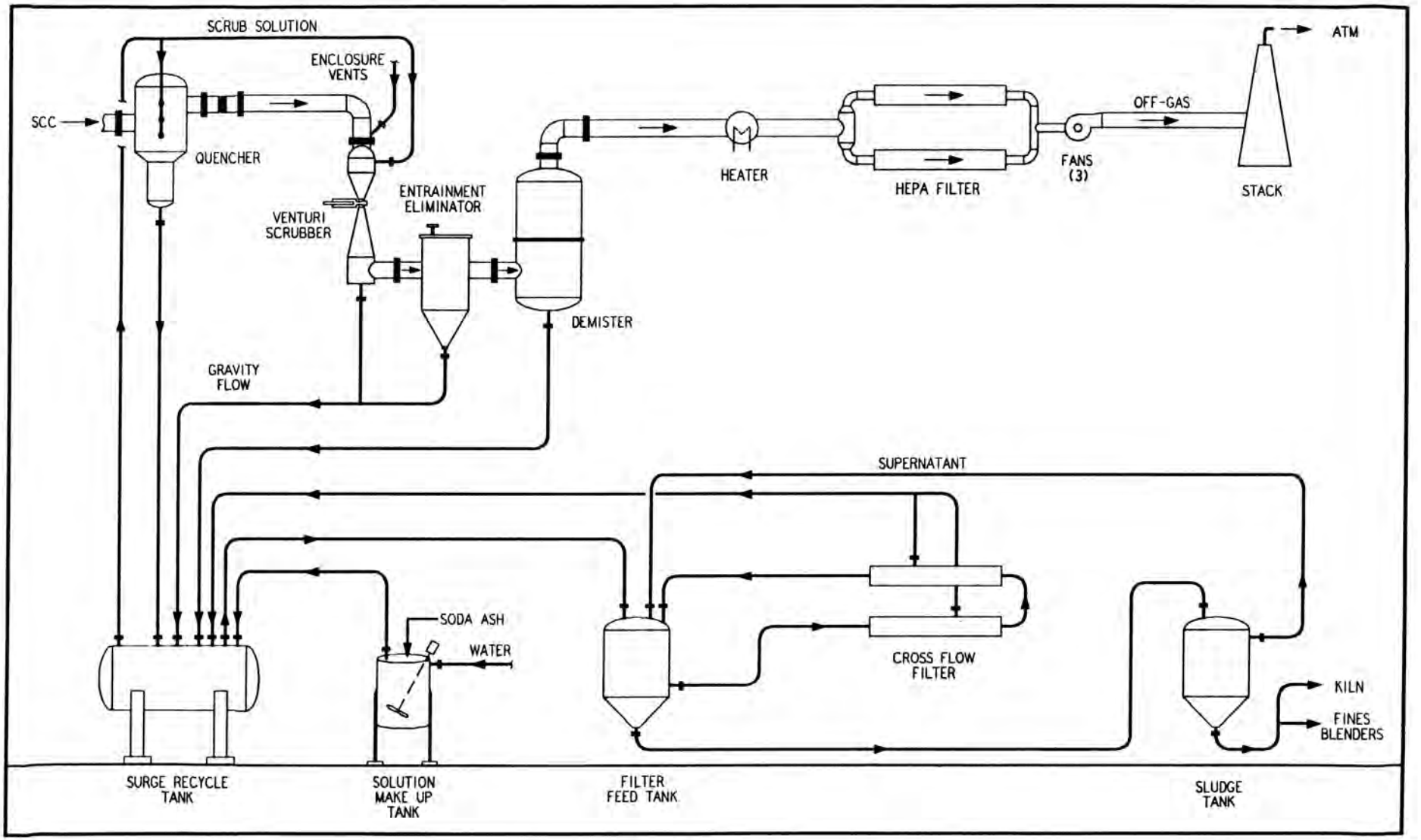

Fig. 3 . PREPP Combustion Gases Cleaning System.

feed input to the discharge end. The RK rotation can be adjusted from 0.1 to 2 rpm.

Secondary Combustion Chamber - The SCC is a rectangular unit with constraints of 21' h x 11' w x 7' d (outside dimensions) with a nominal of 1 ft refractory lining . The SCC is designed to provide the RK off-gas with at least two seconds of retention time at 1900 - 2300°F (2000°F nominal) and 3%w excess oxygen to completely burn any residual hydrocarbons and toxic volatiles.

GROUT PREPARATION AND DRUM FILL SYSTEM

This system, as shown in Fig. 2, consists of a trommel screen, fines blenders, cement and sand day tanks, a grout mixer, and a drum fill. The operation of this equipment is supported by a horizontal stroke vibratory conveyor, fines collection hopper, pneumatic fines conveyor, roller conveyor-vibrating table, hydraulic scissor lift scale-table, gravity roller conveyor, vertical lift, and motorized stacker truck. The horizontal stroke vibratory conveyor is enclosed within a metal shroud. Air is passed in the space between the shroud and conveyor enclosure countercurrent to the conveyor motion to cool the ash and non-combustible residue from the incinerator from 1300°F to 300°F. The air is used as part of the combustion air in the RK. The cooled residue is classified in a trommel screen. The fines are dropped in a chute and collected in the fines hopper and pneumatically conveyed to the fines blenders. The coarse portion is dropped onto the floor of the drum fill enclosure and is manually raked into the 55 gallon drum. The fines, cement, sand, and water are metered into the grout mixer. The grout mix is poured onto the coarse portion and the drum is continuously vibrated until it is filled. The drum is moved from the fill position by the gravity roller conveyor and a lid is loosely installed. The drum is raised by the vertical drum lift to the stacker truck which picks up the drum and places it in the inspection enclosure. After curing, inspecting, siphoning of any free standing water, the lid is tightly installed. The drum is then swiped and decontaminated if required and placed on the storage racks for shipping to SWEPP.

Trommel Screen

It is a rotary double shell drum (about 4' od x 6.75' l and 1 in spacing) which is radially and axially supported to allow free rotation of the trommel, without excessive axial play. The inner shell has round perforations and the outer one has rectangular perforations. The perforations of one shell are staggered in such away that they are not in direct line with the perforations of the other shell. The trommel is designed with speed capability of 4 - 20 rpm in about 2 rpm steps by manual means. The rotary drum is fixed with an airtight shroud to contain the fine materials and designed to operate under a pressure of - 1.2" W.G. to prevent contamination spread.

The trommel is designed to handle a high percentage of coarse materials in some residue mixes and high percentage of fine ash in others at a maximum feed rate of 600 lb/hr. The coarse material which cannot pass through the openings of either or both shells, is normally metal pieces with size constraints of $\leq$ 24" l x 3" w and $\geq$ 0.25" diameter spheres. The fine material ($<$ 0.25" diameter spheres), which can pass through the openings of both shells, is normally fine ash and inerts with an average bulk density of 135 lb/ft^3 and angle of repose of 35°. The coarse portion is dropped into a chute leading to the floor of the drum fill enclosure and the fine portion is dropped into another chute leading to the fines collection hopper.

Fines Blenders and Cement and Sand Storage Tanks

There are two fines blenders, each is an airtight vertical tank (29" h x 31" w x 66" l) with a round bottom, flat top, and a working volume of 20 ft^3. Each blender is designed to store and thoroughly mix the fines portion of the residue of the incinerated waste and process sludge. The anticipated duty cycle for each blender is one batch per week requiring 20 hours of blender operation involving 50 starts staggered by a minimum of 15 minutes under full load.

The cement day tank is 2' id x 6.75' high-overall with a semi-conical bottom and 17 ft^3 capacity. The sand day tank is 2.5' id x 6.75' high-overall with a semi-conical bottom and 27 ft^3 capacity to support the grouting operation.

Grout Mixer and Drum Fill

The grout mixing tank is lined with replaceable plates and equipped with dust enclosures. The mixer has a 1/2 cubic yard capacity with the capability of throughly mixing the fines, sand, cement, water, and additives (binders) and producing mixes with slumps in the range of 3-8" in less than 5 minutes. The fines, sand, and cement are gravity fed to the mixer and additives and water are supplied by a piping system.

The empty plastic lined 55 gallon stainless steel drum (DOT 17C type, 2000 lb maximum capacity) without lid is transferred to the loading area by hands-on method and is placed on an electric powered roller conveyor vibrating table supported by an electro-hydraulic scissor lift scale-table. The coarse portion from the trommel screen is dropped on the floor of the drum fill enclosure through a chute. The drum is manually filled with a predetermined weight of the coarse materials while being vibrated. The grout mix is poured into the drum to fill the voids in the coarse materials and to top off the drum. Upon completion of grout filling, the drum is weighed, the plastic lining is sealed and folded into the drum, a lid is loosely installed, and then the drum is moved from the filling position to the curing and inspection enclosure.

OFF-GAS CLEANING SYSTEM

The SCC interfaces with the quencher in the off-gas wet scrubber system, as shown in fig. 3, by a refractory lined duct with 15" id. The temperature of the gas is reduced by adiabatic (evaporative) cooling from 2000°F to its saturation temperature of $\leq$ 185°F. The enclosure air (shredder, feed and discharge conveyors, trommel, grout mixing, and drum fill) is mixed with the quencher off-gas prior to entering the venturi scrubber and therefore the gas temperature is further reduced to 160°F. The particulates, sulfur oxides, hydrogen chlorides, and some nitrogen oxides are removed from the combustion gases by 0.1%w sodium carbonate scrub solution injected in a variable throat venturi operating at 50" W.G. pressure drop.

The gases and liquid from the venturi are separated in a Chevron type entrainment eliminator. The separated gas is passed into a wire mesh pad type demister to remove residual particulates and mist carryover from the entrainment eliminator. The gas is reheated to 210°F and passed through a set of two

parallel banks of HEPA filters prior to passage into the facility stack for release to the atmosphere.

The scrub solution effluents from the quencher and venturi scrubber, which contain the particulates and soluble chemical contaminants in the combustion gases, are returned by gravity flow to the surge recycle tank (SRT). The scrub solution is prepared by solubilizing sodium carbonate monohydrate in water in the agitated solution makeup tank (SMT). The level of liquid in the SRT is maintained by a fresh scrub solution from the SMT and/or water addition. A solution bleed from the SRT is concentrated to 25% solids in the filter feed tank (FFT) by recirculating the solution through a cross flow filter and returning the filtrate to the SRT. The slurry is allowed to settle and then sluiced from the bottom of the FFT and transferred to the sludge tank (ST). In the ST, the slurry is further thickened to 40% solids by settling and returning the supernatant to the FFT. The thickened sludge containing the combustion chemical contaminants is sluiced from the bottom of the ST and transferred to the kiln for reprocessing or to the fines blenders for encapsulation with the residue of the incinerated waste. For blowdown and/or rework purposes the SRT is connected to the surge recycle drain tank which is located outside the PREPP facility.

Quencher

The quencher is made of Hastelloy and measures 5' id x 14' h with a conical bottom. The lower 7 ft of the quencher including the bottom are lined with 6 in of refractory. The quencher is designed to cool the off-gas (4100 acfm, 2000^{o}F) from the SCC to its adiabatic saturation temperature ($\leq$185^{o}F) by evaporative quenching utilizing two spray rings with full cone spray nozzles providing 41 gpm of scrub solution. A weir with a flowrate of 10 gpm provides a continuous film of the soda ash solution to flow down the inside wall of the quencher and maintains a wet bottom so as to achieve an external wall surface temperature of $<$180^{o}F. The scrub solution is returned to the SRT.

Venturi Scrubber

The quencher off-gas and the air from enclosures and combustion air bypass are mixed into the duct leading to the venturi scrubber. The new flowrate and saturation temperature of the gas mixture entering or leaving the venturi are about 3500 acfm and 160^{o}F respectively. The venturi is made of Hastelloy and equipped with a variable throat designed to achieve a gas velocity of 200-400 ft per second under a differential pressure up to - 50" W.G. More than 99% of the entrained particulates, 95% of hydrogen chloride, 90% of sulfur oxides, and 35% of nitrogen oxides are to be removed from the gas by high efficiency scrubbing with up to 35 gpm of about 0.1%w sodium carbonate solution. The soda ash solution is recycled to the SRT.

Entrainment Eliminator and Demister

The Chevron entrainment eliminator is a wave (corrugated) plate type made of Ferralium alloy and measures 3' id x 6' h with a conical bottom. The scrub liquid is separated from the venturi off-gas (3500 acfm, 160^{o}F) by inertial impaction in the entrainment eliminator with more than 70% efficiency. The separated liquid is returned to the SRT.

The demister is made of Fiberglass and measures 3' id x 5' h with a conical bottom and fitted with SS wire mesh pad. The demister removes any residual particulates and mist carryover from the off-gas of the entrainment eliminator at an efficiency of 100% for $\geq$ 3 micron droplets and 95% for $<$3 micron droplets. The separated liquid is returned to the SRT.

HEPA Filters

The demister off-gas is heated to 50^{o}F above its saturation temperature by an electric heater, rated at 200,000 Btu/hr in the duct. The gas is passed into two parallel banks of HEPA filters, each rated at 2000 acfm, connected to two 1800 acfm induced draft fans and one 1300 acfm exhaust bypass fan to remove any residual particulates in the gas. Each filter bank is 51" h x 27" d x 174" l and consists of a prefilter followed by two stages of filters. The prefilter contains two 24" h x 24" w x 2" thick HEPA filters. Each stage of filters consists of two 24" h x 24" w x 12" thick HEPA filters. The cleaned gas is then routed to the facility stack for release to the atmosphere.

Tanks and Cross Flow Filter

The four tanks, which support the gas cleaning system, are made of fiberglass reinforced plastic. The surge recycle tank is 5' id x 10' l and supplies the quencher and venturi scrubber with a 0.1%w sodium carbonate solution. The scrub solution, which returns to the SRT, contains the scrubbed particulates and soluble chemical contaminants in the combustion gases. The level and strength of the solution in the SRT are maintained by the addition of water and concentrated (25%w) soda ash solution from the solution makeup tank (3' id x 4' l - round bottom and mixer). The composition of the solution in the SRT is controlled by a batch bleed to the filter feed tank.

The FFT size is 4' id x 2.5' h with a conical bottom. The solution accumulated in the FFT is concentrated by high-efficiency filtration utilizing a cross flow (inertial pressure) filter.

The filter is made of stainless steel and rated at 80 gpm solution flow, 4-6 gpm filtrate production, and 0.5 micron porous media. The filtrate is continuously returned to the SRT until the solution is concentrated to about 25% solids. The solution is then allowed to settle in the FFT and the slurry is sluiced from the bottom and transferred to the sludge tank.

The ST size is 4' id x 2.5' h with a conical bottom. The sludge from the FFT is further thickened to 40% solids by accumulation and settling in the ST and returning the supernatant overflow to the FFT. The concentrated sludge is sluiced off the bottom of the ST and routed to the fines blenders or to the kiln for disposal with the solid waste residue from the incinerator.

MISCELLANEOUS

Process Control System and Instrumentation

PREPP is equipped with a computer control and data acquisition system (CDAS) to provide the process information essential for efficient operation and plant safety. The function of the CDAS system is quite diverse and provides several capabilities such as: start and stop equipment, detect and alarm abnormalities in process variables and equipment

malfunctions, analyze and modify/control/ display process variables, data accumulation and retrieval, system failure diagnostics, shutdown and shutdown bypass capabilities, print and describe the current conditions of the process, and print weekly and monthly reports.

PREPP is equipped with the state of the art instrumentation to monitor, process flows, temperatures, pressures, and liquid levels and transmit signals to the central control room console. The instrumentation system is selected with the capabilities of controlling valves, motors, fans, and dampers. Local control operating stations are also provided in the essential areas of the process. In addition to the CDAS, the process is provided with analog instrumentation to enable the control room operator to manually shutdown the process in a safe and orderly manner. Closed circuit TV monitors are provided in the local control panels and central control room to assist in performing various process operations.

Radiological Confinement and Criticality Control

Personnel maximum exposure to radiation is 500 mR per year external exposure and zero internal exposure. The radiation exposure is based on as low as reasonably achievable (ALARA) principle. The average drum contact exposure is 4 mR per hour and average transuranic content of 13 grams per ton of waste. Each area in PREPP is designed and operated to maintain the contamination level to an ALARA value.

PREPP design provides double confinement from the point of entry of waste into the shredder waste feed airlock to the point of discharge from the process decontamination area airlock. The primary confinement barrier (shells of waste containers and process equipment, equipment glove boxes, process enclosures and their ventilation systems) and the secondary one (operating area compartments, building shell and its ventilation system) are separated by airlocks. The plant is separated from the remainder of the building TAN-607 by airlocks and contamination barrier walls with sealed penetrations.

The basic methods for preventing nuclear criticality are limiting the concentration and/or mass of fissile material to safe levels and inspecting for holdup of fissile materials in the process equipment. Criticality neutron alarms and neutron nuclear accident dosimeters are provided for each area where a credible potential for a criticality event exists.

Off-Gas Analyzers

The combustion gases are monitored at the SCC exit, quencher exit, and stack. The analyzers are designed to transmit analog and/or digital electronic signals to a remote direct digital control system.The gases to be analyzed and monitored are: CO, CO_2, SO_2, NO, NO_2, O_2, HCl, and hydrocarbons as methane.

SUMMARY AND CONCLUSIONS

The PREPP design is based on 7 tpd of average transuranic waste, 4100 acfm of combustion gases, and volume reduction from 17:1 to 2:1. The process involves basically shredding and incinerating the waste, immobilizing the residue in a cement concrete, and cleaning the combustion gases with a sodium carbonate scrub solution. The intended operation of the facility is 3 shifts per day, 5 days per week, and 40 weeks per year with a minimum of 10 years service life for PREPP major equipment. The facility design is based on:

1. The latest applicable codes and standards required by the various U.S. institutions for building, equipment manufacturing and installation, personnel safety, and gas effluent.

2. Simple and reliable unit operations incorporating proven and commercially available equipment.

3. ALARA principle to minimize personnel exposure to radiation and maximum containment of radioactivity to comply with the effluent standards of the EPA, DOE, and State of Idaho environmental regulations.

The design of the PREPP facility incorporates and/or provides and/or allows for:

- Hands-on maintenance of equipment and bagout of HEPA filters.
- Handling and incinerating transuranic waste of varied physical and chemical properties under excess air conditions.
- A controlled environment in which to receive and ship, inspect, inventory, and process transuranic waste.
- The state of the art of control equipment and instrumentation for local and central process controls and interlocking the process unit operations.
- The disposal of radioactive and depleted scrub solution and process sludge by routing them to the kiln or grouting operation.
- Interfacing with SWEPP.
- Provisions for future expansion and/or modifications of the process.

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