bed evaporator where excess water is evaporated from the scrubber water. The heater is a vertical, refractory lined vessel that operates at up to 1200°C.

The submerged bed evaporator is an energy recovery system that channels the hot heater outlet gases through a volume of scrubber water, thereby evaporating excess water. The evaporator concentrates scrubber solution to 10 to 20 percent salts. The wet evaporator gases pass through the rotary atomizer scrubber where sulfur and halogen gases are efficiently converted to salts. Sodium hydroxide is metered into the scrubber to neutralize sulfur and halogen gases that are absorbed by the scrubber solution. The outlet of the scrubber is fitted with a mist eliminator that removes particulates and mists from the scrubber outlet.

The clean, moisture-laden gases exit the scrubber and excess moisture is condensed for recycle/reuse in the process. The condenser serves as the process heat sink and serves to control water balance in the SPF. The cool, clean gases are then compressed to atmospheric pressure by the process blower. A continuous emissions monitoring system (CEMs) is provided on the process blower outlet to monitor and record the release of any traces of carbon monoxide, acid gases, total hydrocarbons, and NOx.

The clean, cool process gases commingle with the building ventilation airflow. The combined gases flow through a HEPA filter bank, vent blower and are then released through a monitored vent stack. A complete radiation monitor system measures and documents any trace radionuclides that may pass through the stack. The radiation monitor system includes gamma, beta, alpha, iodine, carbon^{14}, and tritium samplers and detectors.

Salt Handling System

The salts that are formed in the scrubber and concentrated in the evaporator are transferred to the salt handling system, which comprises a filter, an ion exchange system and salt dryer. The concentrated salt solution is filtered to remove any trace particulates that may pass through the pyrolyzer and reformer filters. Any trace radioactive species are removed from the scrubber solution by a high-efficiency, metals selective ion exchange medium. The salt dryer dries the purified salt solution to form a salt cake suitable for direct disposal at a licensed landfill. The dry salt is very low in activity.

Residue Handling System

The reformed, low-carbon residue from the pyrolyzer and reformer is transferred to the high integrity container (HIC) packaging vault. Qualified HICs are filled with the solid, inert residue. Filled HICs are transferred from the packaging vault to a shipping cask be means of a shielded transfer bell. Dual containment and seals are provided on residue handling components. The packaging vault is provided with separate HEPA filtered ventilation system and water washdown capability.

The HIC packaged residue is suitable for direct burial at either the licensed Barnwell or Hanford LLRW burial sites. The packaged residue is also suitable for long-term storage due to its solid, inert, all inorganic nature. The packaged residue is not subject to common problems with long-term storage including bacterial activity and radiolysis of organic compounds.

It is possible to package the low-volume residue in any of the following forms:

- stabilized in High Integrity Containers (HIC);
- compacted, cold-sintered, high-density, metal oxide monolith;
- solidified monolith using polymer sulfur cement, portland cement, thermoplastics, or polymers;
- vitrified monolith using borosilicate or phosphate glass; or
- melted metal monolith.

Spill Protection and Contamination Control

All interior surfaces of the SPF are provided with durable, easy-to-decon coatings. The interior wall and roof panels are of interlocking and sealed construction to eliminate leakage paths from the inside of the SPF to the outdoors. Interior concrete and steel surfaces have a special multi-layer coating to prevent migration of spills or contaminants from the SPF to the environment. The HVAC system also maintains the inside of the SPF at a slight negative pressure relative to the ambient outdoors, effectively eliminating potential airborne releases. Dikes, berms and sumps are located so as to prevent tank leaks and even potential large firewater events from escaping to the outdoor environment.

Auxiliary Equipment and Utility Services

The Process Building contains all auxiliary and utility subsystems required to support SPF operations and THOR[sm] operations including:

Steam Supply	Sluice Water
Nitrogen Supply	Steam Superheaters
Demineralized Water	Service Air
Steam Condensate	Potable Water
Instrument Air	HVAC and Ductwork Dryer
Condensate	Breathing Air
Natural Gas Supply	Cooling Water
Additive Gas	Motor Control Center
Hot Laboratory	DAW Compactor

ANCILLARY BUILDING

The Ancillary Building is designed for storage of spare parts, empty waste shipping containers and equipment for use at customers' locations. A spray dryer and collector are being installed to provide additional salt drying capability for the process. Full salt containers are accumulated for shipment for disposal. Low activity LLRW can also be received and offloaded in the Ancillary Building. Maintenance of plant equipment is also performed in a controlled area. A modular, skid-mounted, pilot-scale THOR[sm] system can be located in the Ancillary or Process Building to perform testing on surrogate and low activity wastes.

ADMINISTRATION BUILDING

The Administration Building has: offices for plant staff and management, control room, switchgear and UPS, health physics and personnel contamination monitoring areas, and count room. The THOR[sm] control room provides remote readout of all process parameters. Trained operations personnel utilize the fully automated supervisory control and data acquisition (SCADA) system to monitor and control all system operations. The SCADA provides a comprehensive human-machine-interface that monitors the PLC panels, instruments, and equipment located in the Process and Ancillary Buildings. Automated safety systems, alarms, and interlocks are provided together with real-time data acquisition and trending. The SCADA provides the operators automated flow diagram windows to monitor and control the process through graphical interfaces.

START-UP ACTIVITIES

SPF start-up activities commenced in February 1999 with the performance of a series of subsystem tests and hot functional tests. Process and SCADA control systems were tested over a several month period to demonstrate reliable performance and to verify that all systems work together as an integrated facility. Operations personnel training was certified on actual operating plant systems. Operating procedures were also verified to be accurate.

Testing activities uncovered several design and equipment deficiencies that were corrected throughout the testing and subsequent operational periods. The main problems encountered during the start-up activities as well as successes are discussed below.

The IER unloading system has worked very well. The incoming resin containers were opened and the dried or wet resins inside were removed as slurries. Using remote devices with very low personnel dose accumulation or direct hands-on effort required. Special stainless steel shipping containers were developed that allowed fully remote removal of incoming resins. Many resins were shipped to the facility in disposable plastic or metal containers that were not compatible with full remote slurrying operations. Such containers required manual intervention to remove the final contents from the container.

The water-slurried IER is transferred to the slurry holdup tanks where the resins are allowed to settle and excess water is then decanted off the top of the settled resin. The original tank manufacturer provided decant devices that did not work as the floats sank and the decant hoses became tangled. A modified, larger decant device with positive alignment guides was installed in each tank with good success. Decant operations require no operator intervention.

The settled IER from the slurry holdup tanks is transferred to the resin feed tank and then the low-water content resin slurry is injected directly into the pyrolyzer. The IER transfers and feed operations have worked very well except when substantial charcoal is commingled with the IER. Additional water flush connections were added to facilitate handling and injection of IER commingled with granular charcoal. Slurry injection lines were modified to remove excess bends.

The pyrolyzer has performed as designed for drying, pyrolyzing and steam reforming the various LLRW feeds processed. A problem was encountered in the superheated steam system that provides fluidizing gases to the pyrolyzer. The steam system did not have adequate condensate removal capability. Accumulated condensate occasionally entered the electrically heated superheaters. The presence of liquids in the superheater caused crack formation of the heater shell due to thermal stresses. The steam system was corrected to provide thorough condensate removal. The super-heated fluidizing gas systems have worked very well.

The pyrolyzer experienced several agglomeration events during testing and initial radioactive operations. Process shutdowns were required to remove accumulated deposits in the fluid bed. The pyrolyzer operating parameters have been adjusted and the design of the IER injector and internals inside the pyrolyzer have been changed with good success. A unique fluid bed media washing station (patent pending) has been added to allow the sand in the fluid bed to be automatically removed and washed to dissolve accumulated low-melting point salts on the sand media, without disturbing pyrolyzer on-line operations. The clean sand media is then returned to the pyrolyzer. No significant agglomerations have occurred for several months.

The ceramic filters have performed with high efficiency except during the initial non-radioactive tests. It was determined that several of the special high temperature seals were not large enough to seal the filter element tubesheet penetrations thereby allowing some reformed residue to bypass the filters elements and enter the gas handling system. Corrected seals have been installed on the tubesheet. Filter removal efficiency is now very high with typical particulate radionuclide removal efficiencies exceeding 99.999 percent.

The gas handling system has performed well except for the carryover of small quantities of salt from the scrubber to the HEPA filters and lower than specified performance of the process blower. A filter baghouse has been added just upstream of the HEPA filters to prevent rapid blinding of the HEPA filters with salt. Larger drive motors have been provided on the process blowers so that process pressures can be adequately maintained during all processing operations.

The salt dryer did not provide the required throughput capacity. Extensive revisions have been performed to the salt dryer system to provide full production throughput capacity and to significantly reduce the hands-on maintenance required of the initial system. A new spray dryer is being installed to provide improved salt drying capacity and to reduce the hands-on maintenance needs of the current salt dryer.

OPERATIONS SUMMARY

Commercial radioactive operations commenced on July 19, 1999. Initial operations were limited for several weeks to processing only very low activity IER at low waste feed rates. This allowed operations staff to gradually implement and perform maintenance activities on system components with full radiological controls but with only very limited radiation and contamination levels. Several plant hardware corrections were identified and accomplished during this period as discussed above. The initial low feed rates of 1 to 2 cubic ft per hour (0.03 to 0.05 cubic meter/hour) have been progressively improved up to the current 8 to 12 cubic ft per hour (0.22 to 0.34 cubic meter/hour) processing rate. Continued efforts are being made to reduce downtime for maintenance activities.

Higher activity IER and charcoal have been progressively received and processed. Table 1 provides a summary of SPF processing throughput and waste processing parameters from the start of commercial operations through February 8, 2000.

Table 1 - Processing Throughput and Parameters

Quantity of Radioactive Resin Processed:	>6,300 cuft (>178 cu meter)
Current Processing Rate:	8 to 12 cuft/h (0.22 to 0.34 cu meter/h)
Highest Activity Resin Processed:	150 R/h (1.5 Sv/h) On Contact
Volume Reductions Achieved:	Incoming Resin Volume : Final Residue Volume
Condensate Polisher Resin:	64:1 to 74:1 (1.3% to 1.5% Remaining)
Cleanup/CVCS/Radwaste System Resin:	15:1 to 58:1 (1.7% to 6.7% Remaining)
Torus Cleanup – High Inorganic Sludge:	5:1 to 8:1 (12.5% to 20.0% Remaining)

The volume reduction of the incoming waste is dependent on the inorganic content of the resin. Resins that are not fully depleted or have been ultrasonically cleaned to remove particulates will have VR factors exceeding 60:1. Typical water cleanup and radwaste resins will have VR factors of 20:1 to 60:1 depending upon the quantity of metals and particulates on the resin. Resins that have a very high inorganic loading, mainly particulates from floor drains and torus sludge removal efforts, may have VR factors as low as 5:1. Pyrolysis and steam reforming can only remove the water and organic fraction of the incoming waste feed. Essentially all inorganic cations (metals) including all non-volatile radionuclides will be in the final, low-volume residue. It is possible however, to change the oxidation state of various metal ions if desirable, e.g. hexavalent chromium is converted to non-hazardous trivalent chromium.

The processing rate has been increased and is anticipated to be at the annualized design throughput of over 60,000 cubic ft (1,700 cubic meter) of incoming IER when the new spray dryer is commissioned in April, 2000.

CONCLUSION

The THOR[sm] process, as implemented in the SPF, has the following features and provides the following significant advantages over other current LLRW processing technologies.

- VR of 20 to 100 for IER wastes;
- WR of 12 to 85 for IER wastes;
- Atom-for-atom processing mode is possible;
- Inert, inorganic, homogeneous, final waste form;
- Direct disposal in qualified HICs;
- Accept IER with contact dose rates up to 150 R/h (1.5 Sv/h);
- Accept LLRW including: IER, graphite, charcoal, SGOG solvents, antifreeze, oils, sludge, high-water content wastes, and high-organic content wastes;
- Packaged final waste form suitable for long-term storage with no risk of gas generation due to bacterial or radiolysis action (residue has no organic content);
- Final waste form is reprocessable to alternative waste forms including vitrification, solidification, encapsulation, cold-sintering, and melting.

FUTURE PLANS

Studsvik has further developed the THOR[sm] process for efficient handling of graphite and mixed wastes by utilizing a simplified single-stage reformer process (patent pending). A modular fluid bed reformer is now being designed for implementation in processing additional IER feed at the SPF. In addition, the modular THOR[sm] reforming system can be transported and or modified to process significant quantities of LLRW and mixed wastes at other sites. Figure 6 illustrates the capabilities of the THOR[sm] process.

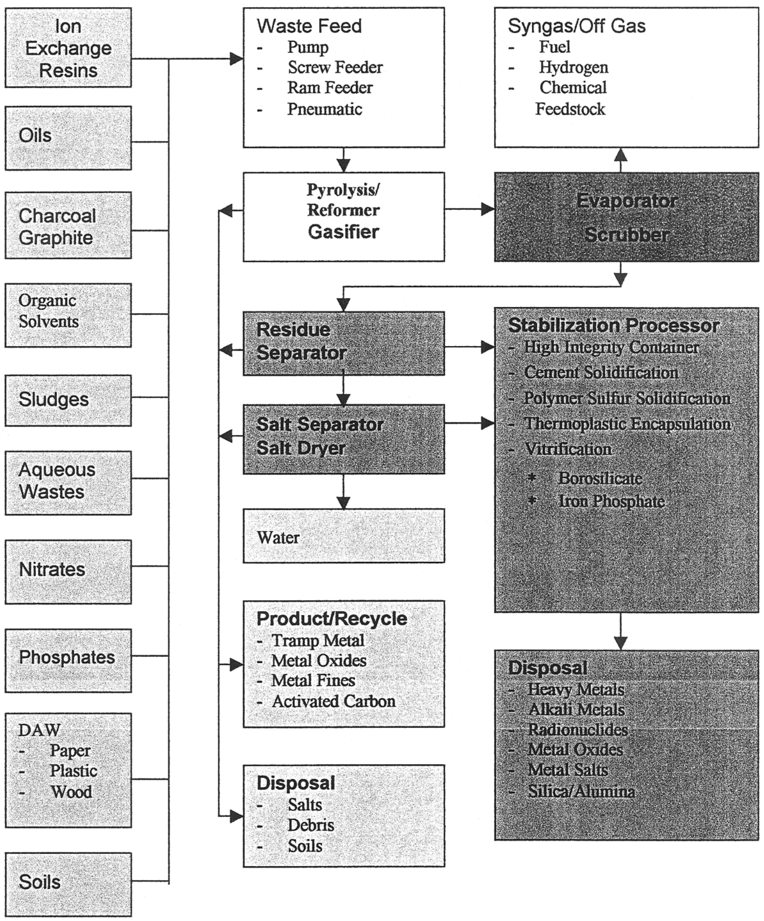

Figure 6 - Block Flow Diagram

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Attachment Two
Studsvik Comments on the Idaho High-Level Waste and Facilities Disposition
Draft Environmental Impact Statement (DOE/EIS-0287D)

Our review of the Draft EIS indicated that there were numerous tasks evaluated that could be more efficiently performed by a steam reformer system. In almost every case, the reforming technology would completely conform to the bounding parameters of the various environmental factors considered.

The following provides excerpts from the draft EIS and our comments on how reforming technology could be utilized to enhance each effort. This information is provided to enable the reader to fully understand the positive impact that reforming technology can have on the waste cleanup efforts at INEEL.

Studsvik highly recommends that an evaluation of the steam reforming technology be incorporated into the final EIS.

There is no significance to the order in which the comments are provided. Comments are provided in the order in which the topic appears in the Draft EIS.

EIS Page No. F-3:

"Notably, DOE and the State did not select a preferred alternative in the draft EIS. The State and DOE will discuss preferred alternatives after considering public input, and the Final EIS will announce the outcome of these discussions."

Studsvik desires that its Pyrolysis/Steam Reforming fluid bed technology be reviewed by the State and DOE, and be considered as an alternative for the processing of SBW, NGLW and other wastes at INEEL as more fully described throughout this document and its Attachments.

EIS Page No. 1-7:

"INTEC's current purpose is to:

- *Develop and apply technologies to minimize waste generation and manage radioactive and hazardous wastes."*

The EIS recognizes INTEC's mission to develop and apply technologies. Through private sector development activities, Studsvik has developed and deployed a patented process system that can be utilized to process a wide variety of nuclear waste forms. With our fluid bed pyrolysis/steam reforming technology, the Studsvik THOR℠ System can be operated in a variety of conversion

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modes (oxidizing and/or reducing) with various additives to process, through organic destruction, evaporation, nitrate conversion, etc., solids or liquid slurries of low-level, mixed and/or high-level radioactive wastes of the following general types:

1. Predominantly organic materials such as ion exchange resins
2. Mixed waste such as materials contaminated with PCBs
3. DAW
4. Solid/Liquid Nitrate Wastes (SBW)
5. High NOx off-gas conversion

The exact adaptation of the process equipment and operating parameters would be based on the specific input waste stream and the specific activity of the input waste. Studsvik's fluid bed approach differs markedly from the fluid bed calciner presently in use at INEEL. The THOR^{sm} process incorporates many features to eliminate the problems associated with that generation of fluid bed systems.

Significant differences include:

1. Direct conversion of nitrates to nitrogen in the fluid bed without the resultant NOx emission problem of the current system.
2. Operation at reduced operating temperatures, thus eliminating the need for bulky additives to prevent molten salt agglomerations.
3. Operation in an "elutriating" mode to prevent the build up of waste salts in the fluid bed
4. Low gas flow for simplified off-gas control system
5. Unique construction for extended lifetime without costly maintenance requirements.
6. Controlled chemical reactions to achieve desired conversion result.

<u>EIS Page No. 1-11:</u>

"As of February 1998, all of the liquid HLW derived from first cycle uranium extraction was converted to calcine. Since that time, calcining of the mixed transuranic waste (SBW and newly generated liquid waste) remaining in the tanks has been underway. There are approximately 1,400,000 gallons of liquid currently in the tanks."

Steam reforming technology can be utilized to directly process the SBW and newly generated liquid waste in a single step process in a more efficient manner than is presently planned for using the existing calciner and/or other methods (should operation of the calciner be halted for environmental reasons).

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<u>EIS Page No. 1-16/17:</u>

"<u>Calcination of Mixed Transuranic Waste/SBW</u>

The SNF & INEL EIS and Record of Decision determined that HLW and mixed transuranic waste/SBW in the Tank Farm should continue to be calcined while other treatment options were studied. Unlike the liquid HLW, the mixed transuranic waste/SBW cannot be calcined directly due to the presence of low melting point alkali compounds formed during calcinations that clog the New Waste Calcining Facility calcine bed. A large amount of nonradioactive aluminum nitrate solution must be added to the waste before it is fed into the calciner. In order to meet its commitments to complete calcinations of the liquid mixed transuranic waste/SBW by December 2012, DOE studied alternative methods for calcining this waste. Two techniques emerged as viable candidates: (1) high temperature calcinations and (2) sugar-additive calcinations (LMITCO 1977). Based on the results of the pilot plant studies, DOE determined high temperature calcinations to be the viable technological solution. High temperature calcinations will be demonstrated during calciner operations through June 2000."

THOR^{sm} utilizes a steam fluidized bed of inert material. The bed is heated by electrical steam superheaters. Steam reformation reactions can occur in auto-thermal mode requiring no additional energy input. Sodium compounds do not adhere to the bed media but are constantly elutriated out of the bed. The high, instantaneous conversion of low melting nitrates to nitrogen eliminates the potential agglomeration in the bed. Sodium oxide compounds are formed that have eutectic melting points higher than the Reformer operating temperature.

THOR^{sm} does not require the addition of aluminum nitrate to prevent alkali compound related agglomerations. Sugar additive can be performed in the THOR^{sm} process with no design changes. The THOR^{sm} reformer fluidized bed does not require high temperatures to provide complete nitrate conversion.

This technology had its genesis in fluid bed technology for biomass gasification, but is truly a next generation design which offers the following advantages for radioactive service:

- Reformer has significantly reduced off-gas volume of 1/8th to 1/20th of the off-gas volume of the current calciner.
- Reformer has gaseous NOx emissions that meet MACT standard without addition of gaseous de-NOx unit. Nitrates are fully converted to N_2 in the reformer fluid bed. Reformer has estimated NOx emissions at 1/1,000th of those emitted from current calciner.
- Reformer minimizes use of additives to prevent agglomerations. Low temperature operation minimizes or eliminates the need for additives to prevent alkali metal compounds from melting in the bed. This also significantly reduces the final volume of the end product.
- Reformer provides high conversion of nitrates to nitrogen and minimizes or eliminates the presence of nitrates in the high sodium end product.
- Reformer has lower Cs volatility than high temperature units operating over 600°C.

- Efficient mercury recovery unit can be easily utilized in the off-gas from the reformer.
- Construction labor to build new plant is estimated to be 2 times that required for performing continued current operations modifications of adding a de-NOx unit to existing calciner off-gas system. The new reformer plant could be designed and built to meet the same schedule as estimated to modify the existing calciner.

EIS Page No. 1-17:

"*Immobilization Technologies*

……DOE identified two ways to treat mixed transuranic waste/SBW and calcine: direct immobilization or radionuclide separation followed by vitrification………"

Granular solid sodium-bearing product from the reforming process is amenable to direct immobilization or radionuclide separations followed by vitrification.

EIS Page No. 1-32:

"The Advanced Mixed Waste Treatment Project (AMWTP) EIS -

……. The AMWTP EIS is potentially relevant to the proposed HLW EIS because a portion of the inventory of radioactive waste at INTEC may be considered for treatment at the proposed AMWTP. .."

57-3 X1(5) Due to the flexibility of the reforming technology, it could be directly incorporated into the AMWTP as a potential replacement for the cancelled incinerator. If this were to occur, consideration should be given for utilization of this system to not only address low-level mixed wastes but also SBW and other INEEL waste streams. This would provide significant savings in overall facility construction and operational costs can be achieved, as well as providing for a superior technical solution.

EIS Page No. 2-4:

Section 2.2 states that DOE will evaluate *"….. innovative alternative scenarios and technologies…"*

"….it was determined that there are alternative technologies that would not involve calcining waste prior to further treatment…."

Steam reforming constitutes an innovative alternate technology of this type. Steam Reforming is a non-incineration thermal treatment process.

EIS Page No. 3-2:

"*Time lines for alternatives analyzed in the EIS*

The general timeframe for the waste processing alternatives analyzed in the EIS extends from the year 2000 through 2035. The year 2035 is when, in accordance with the Settlement Agreement/Consent Order, DOE must have all HLW treated and ready to be shipped to a storage facility or repository outside of Idaho. Specifically, this agreement states that all the liquid in the eleven 300,000-gallon, below -grade tanks would be calcined, treated, and ready to be transported out of Idaho by a target date of December 31, 2035. ……"

See comments to page No. 3-3 below.

EIS Page No. 3-3:

"The Settlement Agreement/Consent Order specifies that calcinations shall be completed by 2012.

………However, because some of the waste processing alternatives evaluated new treatment technologies at INTEC that would not use the calciner, the 2012 date for having all liquids out of the tanks would not be practicable under those alternatives. Time frames in these instances are dictated by the amount of time needed to design, construct, and permit a new treatment facility and how long it will take to treat the liquid and the calcine using the selected technology."

Throughout the EIS, reference is made to the time lines committed to in the Settlement Agreement/Consent Order. It was recognized that the alternative of development of a completely new technology to address the INEEL needs was not practicable because that approach would not be able to meet the ultimate processing deadlines.

Studsvik's THOR℠ technology is directly applicable to the processing of the waste currently processed in the calciner, is fully developed and deployed, and solves many of the current problems associated with calciner operations.

Studsvik can easily support the specified schedule as the THOR℠ process is now being used on a large-scale commercial basis to process a variety of LLRW using steam reforming. The Studsvik Processing Facility has a current throughput of approximately 75% of the existing INTEC calciner.

The technology could be deployed in a relatively short period of time:

Demonstrate to DOE	1 year
Licensing/Permitting	1 year
Design	1.5 years
Procurement/Construction	2.5 years
Testing	0.5 years
	6.5 years

The above estimates are based on a similar activity just completed for our commercial processing facility in Erwin, TN with appropriate additional time added for additional DOE requirements.

Through expedited efforts, the large majority of the waste under consideration could be processed before the year 2012.

Alternatively, a THOR[sm] steam reformer could be installed on the outlet of the existing calciner to convert the gaseous NOx to nitrogen without needing to modify the current calciner in any way. The NOx converter could be installed according to the following schedule

Demonstrate to DOE	1 year
Design/ Permit Revision	0.4 year
Procurement/Construction	2.5 years
Testing	0.1 years
	2.5 years

EIS Page No. 3-10:

"New Waste Calcining Facility

……. Calcination does not meet the applicable RCRA treatment standards for the INTEC waste and is considered an interim treatment step to stabilize the waste in a solid form pending its final treatment.

The Notice of Noncompliance Consent Order requires that the calciner be placed in standby in June 2000, pending DOE's decision whether to seek a permit or close the facility. Before continuing calciner operations, upgrades to the off-gas treatment system would be required to comply with the Maximum Achievable Control Technology air emissions standards. ... "

NOx Off-gas control is perhaps the most significant advantage of the THOR[sm] technology. During the extensive, multi-year test program, Studsvik identified the need for a simple, single-step nitrate destruction process. Tests were performed to determine the capabilities of THOR[sm] for nitrate destruction. A unique combination of operating parameters and equipment design

yielded a simple system that can process liquid, slurry, solids and/or gaseous nitrates (NOx) in a safe and efficient operation.

Nitrate destruction tests confirmed that the THOR[sm] fluid bed system can achieve the following performance specifications:

Nitrate Feed:	5.2 M $NaNO_3$, in water slurry
Processing Rate:	Proprietary
Reductant:	
Main Additive:	Sucrose (granular sugar)
Other Additive:	Proprietary
Addition Rate:	Proprietary
Fluidizing Medium:	Proprietary Bed Material Used
Fluid Bed Media:	<2% nitrates, during steady state operation <0.5% nitrates during startup and shutdown periods
Heating Method:	Electrical Resistance Heaters
Operating Temp.:	450-700°C
Nitrate Destruction:	>99 percent, in solid outlet stream
Chromium +6:	Converted to Cr^{+3}, below detectable levels of Cr^{+6} on TCLP test
Bed Agglomerates:	None
Off-gas System:	Thermal Oxidizer and Scrubber
NOx in Off-gas at Outlet of THOR[sm] Fluid Bed (prior to thermal oxidizer and scrubber):	
At Startup:	>5,000 ppm, quickly dropped within one hour to steady state values
Steady State:	<100 ppm, normally <50 ppm, 25% of test time <15 ppm

NOx measurements were made continuously on-line using an extractive EPA method. In addition, gas bag samples were analyzed off-line at a certified lab. Off-gas analysis from a typical large-scale test run shows below detectable levels for NO and NO_2 and approximately 69 ppm of N_2O. Depending upon local air permit requirements, the THOR[sm] process will require no NOx off-gas control system.

We have performed numerous nitrate destruction tests utilizing fluid bed and mechanical contactor hardware over the past several years. The current process application practices have proven to be safe, efficient and easy to control.

Utilization of Studsvik's approach would provide for waste processing that meets the MACT requirements in a single process operation thus yielding a "final" rather than an interim solution. The THOR[sm] gaseous NOx conversion reformer far surpasses the ability of any other commercial scale technology for converting high NOx input streams directly to nitrogen.

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EIS Page No. 3-11:

"Newly generated liquid wastes has historically been added to the liquid mixed transuranic waste in the below-grade tanks. Consequently it has been similarly managed, calcined, and transferred to bin sets where it is combined with HLW. However, DOE has determined that by September 30, 2005, new tanks will be constructed and available to accept the newly generated liquid waste. ....."

See comments provided in response to EIS Page No. 3-3 statements.

EIS Page No. 3-61:

"3.3.7 TREATMENT OF MIXED TRANSURANIC WASTE/SBW AT THE ADVANCED MIXED WASTE TREATMENT PROJECT

......For these reasons, the option of treatment of mixed transuranic waste/SBW at the Advanced Mixed Waste Treatment Project was eliminated from further consideration in this EIS."

57-4 X1(5) This section discusses the modifications that would be required to the AMWTP to enable the processing of SBW and makes the conclusion that such modifications would disrupt the schedule for the AMWTP and jeopardize compliance with the Settlement Agreement/Consent Order and increase costs.

With the recent event of termination of the incinerator system originally incorporated into the AMWTP, there is the potential that improved technology such as pyrolysis/steam reforming may be incorporated into the final revised facility design. If this were to be the case, then it could prove beneficial to include an evaluation of steam reforming and an evaluation of processing of SBW at the AMWTP in the final EIS

Processing of SBW at AMWTP was not considered in part due to the need for modifications that would no longer be applicable should a reforming system be employed:

1. Dry input form required - reforming technology can utilize a liquid slurry or solid waste input feed.
2. Pretreatment such as cesium ion exchange would be required - a reforming system can be easily shielded to handle high activity wastes.
3. Mods to off-gas system for NOx - a reforming system can directly process nitrates to nitrogen gas.

The THOR[sm] steam reformer process could be utilized in the AMWTP to destroy the nitrates in the mixed TRU/SBW. The resultant nitrate free, alkali compounds could then be efficiently packaged as TRU waste including grouting as required.

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Appendix B-9:

"B.3.3 CANDIDATE ALTERNATIVES"

This section indicated that DOE included all reasonable and viable alternatives that were available through late 1997. The Studsvik steam reforming facility was in its construction phase at that time and did not have demonstrated performance on a large-scale, commercial basis, thus it was not included in the evaluation.

The steam reforming technology does come within the overall boundaries of the various technologies that were expressly mentioned in the Draft EIS. Due to its many advantages as described in this document, an evaluation of this technology should be included in the final EIS.

Appendix B-10:

"B.3.3.2 Alternatives Not Considered for Initial Analysis

.....(2) required significantly more development work to achieve technical maturity, ..."

Steam reforming for processing of nuclear waste has now been fully demonstrated with the opening and subsequent commercial large-scale radioactive operation of the Studsvik Processing Facility.

Appendix C. 6-25:

"C.6.2 PROJECT SUMMARIES
Waste Processing Projects

C.6.2.1 Calcine SBW Including New Waste Calcining Facility Upgrades (P1A)"

Appendix C. 6-31:

"C.6.2.2 Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B)"

We have reviewed the construction and operational summaries provided in the referenced sections and find that construction and operation of a steam reforming facility would fall within the boundaries of these specifications.

Due to the similarities of environmental effects of steam reforming technology to the technologies fully evaluated, revisions to the EIS are felt to be feasible in a relatively short period of time with no expected alternations to the fundamental findings.

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Attachment Two
Studsvik Comments - Draft EIS
Page 10

Appendix C.6-73:

"C.6.2.10 HAW Denitration, Packaging and Cask Loading Facility (P9J)

…… The denitrator would be a fluidized bed reactor. The evaporator bottoms, mixed with a 2.2M aluminum nitrate solution would be fed into the bed. Kerosene and oxygen would also be fed into the reactor to maintain the reactor temperature of about 600 ºC. The aluminum nitrate reacts with the waste to form solid pellets (calcine)."

The Draft EIS provided a summary description of Project Number P9J, HAW Denitration, Packaging and Cask Loading Facility (listed in Table C.6.1-1 and more fully described in section C.6.2.10, page C.6-73).

The THOR℠ steam reformer operates as an elutriating fluid bed. However, reference should be made to use of electrical heating and auto-thermal steam reforming for maintaining fluid bed operating temperatures of 450 to 700°C. The use of aluminum nitrate can be utilized in the Reformer, however, the use of such additives to prevent alkali; metal agglomerations are generally not necessary with the THOR℠ Reformer.

COGEMA, INC.

HLW & FD

EIS PROJECT - AR/PF
Control # DC-58

Mr. Thomas L Wichmann
EIS Document Manager
850 Energy Drive, MS 1108
Idaho Falls, Idaho 83401-1563

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April 14, 2000

Dear Mr. Wichmann

Subject: COGEMA, Inc. Comments on the "Idaho High-level Waste and Facilities Draft Environmental Impact Statement (EIS)

COGEMA, Inc. is pleased to submit the attached comments on the December 1999 draft "Idaho High-level Waste and Facilities Draft Environmental Impact Statement (EIS)".

58-1
III.D.4(4)
As summarized in the attachment, there is a cost-effective, mature, industrial technology, which can be used to solidify the INEEL sodium bearing waste. This technology was not considered in the Draft EIS. COGEMA, Inc. encourages the Department of Energy to permit use of this technology in the Final EIS and Record of Decision (ROD).

If there are any questions or if additional information is needed, please contact me at the number referenced below, or Arvid Jensen (208-524-0466).

Sincerely yours,

Rhonnie Smith

Rhonnie Smith
Executive Vice-President, Engineering and Technology

cc:
Arvid Jensen

7401 WISCONSIN AVENUE, BETHESDA, MARYLAND 20814-3416 TEL. (301) 986-8585 TELEFAX: (301) 652-5690