SUPPORTING INFORMATION FROM STAKEHOLDER QUESTIONS RAISED AT JUNE 16 SILOS PROJECT PUBLIC WORKSHOP

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COMPARATIVE EVALUATION OF SILO 3 STABILIZATION ALTERNATIVES

THRESHOLD CRITERIA

EVALUATION CRITERION	CEMENT STABILIZATION	POLYMER (micro) ENCAPSULATION	SULFUR/POLYMER ENCAPSULATION	VITRIFICATION
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	<= = = = = = = = = = = = = =	All alternatives are very protective: Waste form effectively immobilizes all hazardous and radiological constituents to meet disposal facility WAC Potential disposal facilities are in remote, arid locations with no nearby receptors, thereby minimizing the potential for human or ecological exposure Engineered disposal design minimizes potential for access by inadvertent intruders Short-term (transportation) risks to the public are maintained well within CERCLA criteria (see short-term effectiveness evaluation)	= = = = = = = = = = = = = =	= = = = = = = = = = = = = =>
COMPLIANCE WITH ARARS	<= = = = = = = = = = = = = =	All four alternatives can comply with current ARARs No modifications to ARARs approved in OU4 ROD will be required or requested	= = = = = = = = = = = = = = = = =	= = = = = = = = = = = = = >

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COMPARATIVE EVALUATION OF SILO 3 STABILIZATION ALTERNATIVES

BALANCING CRITERIA

LONG-TERM EFFECTIVENESS AND PERMANENCE

CEMENT STABILIZATION	POLYMER (micro) ENCAPSULATION	SULFUR/POLYMER ENCAPSULATION	VITRIFICATION
<= = = = = = = = = = = = = =	All four alternatives provide adequate long-term effectiveness Disposal facility design and location minimizes exposure of treated waste to potential degradation mechanisms (freeze thaw, groundwater infiltration, etc), thus maintaining the protectiveness discussed above	= = = = = = = = = = = = = = >	Most physically durable waste form - least susceptible to degradation due to freeze/thaw or groundwater infiltration; however, these mechanisms are not expected to be significant factors for any of the four waste forms at the potential disposal locations

COMPARATIVE EVALUATION OF SILO 3 STABILIZATION ALTERNATIVES
BALANCING CRITERIA

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

	CEMENT STABILIZATION	POLYMER (micro) ENCAPSULATION	SULFUR/POLYMER ENCAPSULATION	VITRIFICATION
TOXICITY	<==========	None of the four alternatives provide destruction of toxic constituents - no significant reduction of toxicity is accomplished. All four alternatives provide effectiveness by immobilizing toxic constituents	==========	==========>
MOBILITY	Demonstrated ability to immobilize same hazardous constituents as those present in Silo 3 waste through OU4 FS and subsequent testing, and both FEMP and commercial treatment of similar wastes	Pilot-scale testing on wastes similar to Silo 3 waste shows ability to successfully immobilize hazardous constituents.	Pilot-scale testing on wastes similar to Silo 3 waste shows ability to successfully immobilize hazardous constituents.	Vitrification Pilot Plant program demonstrated the ability to immobilize COCs in Silo 3 surrogate to meet WAC
VOLUME	Estimated 20% volume increase	Assumed equivalent to Cement Stabilization, based upon U.S. EPA literature review. Could potentially provide lower treated waste volume than cement stabilization - development work is required to confirm actual treated waste volume	Assumed equivalent to Cement Stabilization, based upon U.S. EPA literature review Could potentially provide lower treated waste volume than cement stabilization - development work is required to confirm actual treated waste volume	Potential volume decrease of up to 50% ; Dilution of untreated waste in order to manage sulfates could reduce or eliminate volume decrease.

COMPARATIVE EVALUATION OF SILO 3 STABILIZATION ALTERNATIVES
BALANCING CRITERIA

SHORT-TERM EFFECTIVENESS

	Cement Stabilization	Polymer (micro) Encapsulation	Sulfur / Polymer Encapsulation	Vitrification
Worker Risks	Lower than other three alternatives due to lower operating temperature and minimal particulate generation	Operating temperatures are slightly higher than Cement Stabilization, but lower than Sulfur/Polymer Encapsulation or Vitrification. Lower risk than Vitrification due to lower operating temperatures and shorter period of operation	Higher than Cement Stabilization or Polymer Encapsulation due to higher operating temperatures; lower risk than Vitrification due to lower operating temperatures and shorter operation period	Higher than other three alternatives due to higher operating temperatures, more complex equipment and longer operating period
Transportation Risk	<= = = = = = = = = =	Calculated transportation risk well within U.S. EPA guidelines	= = = = = = = = = = =	= = = = = = = = = = = >
Clean-up Time	Most certain, anticipated to be shorter than Vitrification due to higher achievable capacity. Less than 9 months operations time	U.S. EPA literature indicates clean-up time should be roughly similar to that achieved by cement stablization/solidification	U.S. EPA literature indicates clean-up time should be roughly similar to that achieved by cement stablization/solidification	Based upon Vitrification Pilot Plant experience, anticipated to be longer other three alternatives due to lower achievable capacity. Greater than 2 years operations time

COMPARATIVE EVALUATION OF SILO 3 STABILIZATION ALTERNATIVES
BALANCING CRITERIA

IMPLEMENTABILITY

	CEMENT STABILIZATION	POLYMER (micro) ENCAPSULATION	SULFUR/POLYMER ENCAPSULATION	VITRIFICATION
ADMINISTRATIVE IMPLEMENTABILITY	<= = = = = = = = = =	NTS tentatively confirms acceptability of treated waste under existing PA	= = = = = = = = = = = = = =	= = = = = = = = = = = = >
TECHNICAL IMPLEMENTABILITY	Most implementable of the four alternatives Least complex equipment and facility requirements of the four alternatives Has been successfully implemented on a commercial scale to treat mixed waste at numerous DOE and non-DOE superfund sites (see attachment) Has been successful at FEMP on wastes (thorium waste) very similar to Silo 3 waste	More uncertain than cement stabilization due to limited commercial implementation More complex facility and equipment requirements than cement stabilization Successful on a bench scale with mixed waste and pilot-scale with surrogate (Brookhaven National lab)	More uncertain than Cement Stabilization due to limited commercial implementation More complex facility and equipment requirements than cement stabilization or polymer (micro) encapsulation Successful on a pilot scale; SEG has a small-scale commercial facility	Complex equipment and high temperatures impair implementability Most uncertain of the four alternatives from a technical standpoint based upon experience from Vitrification Pilot Plant and Savannah River

COMPARATIVE EVALUATION OF SILO 3 STABILIZATION ALTERNATIVES

COST

CEMENT STABILIZATION	POLYMER (micro) ENCAPSULATION	SULFUR/POLYMER ENCAPSULATION	VITRIFICATION
Due to wide-spread commercial implementation and more certain technical implementability, cost is most certain of the four alternatives Higher treated waste volume (assuming dilution is not required for vitrification) results in higher packaging, transportation, and disposal costs than vitrification Shorter period of operation results in lower operating and maintenance costs than vitrification Less complex facility and equipment requirements result in lower capital costs than vitrification $25 million*	Assumed roughly equivalent to cement stabilization due to expected similar waste volume and capital costs (based upon U.S. EPA literature review) Cost is more uncertain due to limited commercial-scale basis for estimate	Assumed roughly equivalent to cement stabilization due to expected similar waste volume and capital costs (based upon U.S. EPA literature review) Cost is more uncertain due to limited commercial-scale basis for estimate	Experience from Pilot plant program and subsequent evaluations provide basis for estimating Silo 3 cost Lower treated waste volume (assuming dilution is not required) results in lower packaging, transportation, and disposal costs than cement stabilization Longer period of operation results in higher operating and maintenance costs than cement stabilization Complex facility and equipment requirements result in higher capital costs than cement stabilization $61 million*

*Rough order-of-magnitude cost estimates

GENERAL INFORMATION ON THE ATTACHED SPREADSHEET

The intended purpose of the attached spreadsheet is to identify non-DOE sites that have utilized either cement stabilization or encapsulation technologies to treat hazardous, radioactive or mixed waste forms. All of the sites that are listed have utilized the abovementioned technologies or some slight derivation of the technology. A close review of the attached spreadsheet will reveal that there is not consistent information provided for each site listed (e.g., some have dates, varying degrees of detail are presented on the waste form). The level of detail in the spreadsheet is a function of the amount of information that was available for each site. Some information sources gave extensive detail on a particular site, while other sources provided very little detail.

It is also important to keep in mind that there appear to be slightly different definitions of cement stabilization. In some cases the terms stabilization and solidification are used synonymously with cement stabilization and in other cases these terms carry a slightly different definition. Every effort has been made to try and clarify what type of cement stabilization was utilized at a particular site; however, in some cases there simply was not enough detail provided on a particular site.

Finally, there is also a number of DOE applications of cement stabilization that were not previously identified and reported to stakeholders. Those DOE applications have been provided on the last page of the spreadsheet and are intended to supplement previously reported information.

The information contained in the attached spreadsheet was obtained from numerous sources including professional journals, electronic databases and from information obtained directly from specific agenceis, universities and corporations. A partial list of the journals that were consulted for the attached information include the *Journal of Hazardous Materials*, *Remediation*, *Environmental Protection*, and the *Journal of Environmental Science and Health*. The electronic databases that were accessed include the Superfund Innovative Technology Evaluation (SITE) Program, the Alternative Treatment Technology Information Center (ATTIC) and both the U.S. EPA and OEPA Internet Homepages. Information was also obtained from a variety of other published information and Internet Homepages for specific Agencies, Universities and Corporations.

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STABILIZATION TECHNOLOGY AT NON-DOE SITES

SITE	TECHNOLOGY	WASTE FORM	RESULTS	COMMENTS
West Jordan, UT *(Superfund)*	Cement stabilization	Soil contamination with lead and arsenic	Successful	• 2500 m^3 were processed • Cement Kiln dust used as an additive • Crushing was used on "oversized" material
Douglasville, PA *(Superfund)*	Cement stabilization	Drums, sludge ponds, etc., containing oil, organics and lead	• Successful for immobilization of heavy metals • Did not immobilize volatile and semi-volatile organics	• Use of additive called chloranan
Carolinas Stadium Site Charlotte, NC *(Superfund)*	Cement stabilization	Contaminated soil - lead, PCBs, semi-volatiles	Successful	• 3,800 cubic yards were disposed of in TSCA landfill in Idaho (Envirocare) • 16,200 cubic yards were also stabilized before being placed into a waste cell
Naval Construction Battalion Center Port Hueneme, CA *(Superfund)*	Cement stabilization	Soil, sediments and sludge	Successful	• Spent blasting abrasives and soluble silicates used as additives
Robins AFB Macon, GA *(Superfund)*	Cement stabilization	Soil, sediments and sludge	Successful	• Addition of pozzolanic material
Environmental Technology Lab Taejon, Korea	Cement stabilization	Hazardous waste Organics and metals	Successful	• Low leach rates for both organics and metals • Added silica-fume as part of mixture
Bucknell University, PA	Cement stabilization	Three year study on petroleum refinery waste	Mixed success - concluded that without satisfactory treatability study	• Use fly ash organo-philic clay and quicklime as additives - mixture had a significant effect on volume increase
Portable Equipment Salvage Co., OR	Stabilization with pozzolanic material	Hazardous waste - copper, lead and chromium	Successful	• Reduce TCLP extr[illegible] by 94-99% • Volume increase of 20-50% • No significant air emissions
Robins AFB, GA	Stabilization with pozzolanic and other additives	Hazardous waste with high organics, inorganics	Successful	• Additives are proprietary developed by Wastech, Inc.

STABILIZATION TECHNOLOGY AT NON-DOE SITES

SITE	TECHNOLOGY	WASTE FORM	RESULTS	COMMENTS
Santader, Spain	Cement stabilization	Steel foundry wastes (dust) (hazardous waste)	Successful	——
U.S. Army Construction Engineering Research Lab	Cement stabilization	Hazardous waste Print blast waste with metals	Successful	• Leaching of metals was controlled in stabilized waste form
Portable Equipment Salvage Clackamas, OK *(Superfund)*	Stabilization - calcium and dry silica	Soil, sediment, sludge metals	Successful - 99% reduction in metals	• Limited effectiveness against SVOC and pesticides
Brookhaven National Laboratory	Polyethylene encapsulation (micro and macro)	Low-level radioactive Mixed waste Hazardous	• Success at bench scale on nitrates • Success at full scale with surrogate	• Achieved volume reductions greater than that of cement stabilization • Work being carried out in conjunction with Hanford, Rocky Flats, and INEL
Envirocare of Utah	Polyethylene encapsulation	DOE and commercial mixed waste	Successful	• 400,000 pounds processed
American Creosote, FL *(Superfund)*	Solidification	Contaminated soil	Successful	• Did not define solidification technology
Sacramento Army Depot	Stabilization	Contaminated soil burn pits and oxidation lagoons	In process	• 40,000 cubic yards • Did not define stabilization technology
Various Sites - Nevada and California	Cement stabilization	Contaminated soil and liquids Hazardous waste	Successful	• GLT Company has utilized technology at numerous sites
Brookhaven National Laboratory and ACOE	Cement stabilization	Sediments contaminated with organics and metals	• Success at bench scale • Pilot scale results not available	• Technology called "cement-lock" • Temperature of 2300-2400 F caused organics to oxidize
Buffalo River, NY	Cement stabilization	Contaminated sediments	• Success at bench scale	• Kiln dust and lime/fly ash used as an additive
Lasser College, CA	Cement stabilization	Soil contaminated with lead and cadmium	Successful	• Sodium silicate used as additive • Bench scale demonstration

STABILIZATION TECHNOLOGY AT NON-DOE SITES

SITE	TECHNOLOGY	WASTE FORM	RESULTS	COMMENTS
Army Materials Testing Lab, Waterdown, MA	Cement stabilization	Mixed waste (Cadmium, Chromium, Uranium)	Successful	• 380,000 pounds of waste processed • Acceptance for disposal at Envirocare
Eglin Air Force Base	Cement stabilization	Radioactive waste (contaminated sand)	Successful	• 3,600 drums processed
Lake City Army Ammunition	Cement stabilization	Mixed waste - sludges	Successful	——
British Plaster Board, Inc.	Cement stabilization	Soil - radioactive	Successful	• 600 drums processed
DuWald Steel	Cement stabilization	Mixed waste - soil (lead and radium)	Successful	• 4,000 tons processed
Florida Steel Corp.	Cement stabilization	Radioactive - furnace dust	Successful	• 14 cubic yards processed
General Electric Aircraft	Cement stabilization	Powder - Thorium	Successful	——
Maxey Flatts *(Superfund)*	Cemer [illegible]zation	Mixed waste	Successful	• 5,000 gallons processed
Metcoa Site *(Superfund)*	Cement stabilization	Hazardous waste	Successful	• 300 drums processed
Westinghouse Nuclear Fuels	Cement stabilization	Radioactive sludge	Successful	• 600,000 gallons processed
NewPort News Shipbuilding	Cement stabilization	Mixed waste - lead and U-238	Successful	——
Pratt and Whitney	Cement stabilization	Mixed waste	Successful	——
Los Angeles Harbor	Cement stabilization	Hazardous waste - soil	Successful	• 60,000 tons processed
Pennington Army Co.	In situ stabilization	Hazardous wastes - sludge	Successful	• 50,000 cubic yards processed
General Motors - Allison	In situ stabilization	Hazardous waste - sludge	Successful	• 80,000 cubic yards
General Motors - Inland Fisher	Cement stabilization	Hazardous wastes - soil	Successful	• 20 acre area

STABILIZATION TECHNOLOGY AT NON-DOE SITES

SITE	TECHNOLOGY	WASTE FORM	RESULTS	COMMENTS
Vickery Surface Impoundment (RCRA Closure)	Cement stabilization	Hazardous waste - sludge PCBs and Dioxin	Successful	• 400,000 cubic yards processed
Pioneer Sand Site *(Superfund)*	Cement stabilization	Hazardous waste - sludge metals and organics	Successful	• 6,000 cubic yards
Pratt and Whitney	Cement stabilization	Hazardous waste - soils Fuel oil and PCBs	Successful	• 9,000 cubic yards processed
Mobay Corp.	Cement stabilization	Hazardous waste sludge	Successful	• 40,000 tons processed • Filtration used prior to stabilization
IFF Lagoon	Cement stabilization	Hazardous waste sludge	Successful	• 5,000 cubic yards processed
Dupont	Cement stabilization	Hazardous waste - lead and mercury	Successful	• 32,000 tons processed
Lacks Industries	Cement stabilization	Hazardous waste Sludge, soil, debris	Successful	• 25,000 tons processed
DOW Chemicals	Cement stabilization	Hazardous waste - sludges	Successful	—
Carolina Power and Light (numerous plants)	Cement stabilization	Radioactive wastes	Successful	• 50,000 ft^3 processed
Susquehenna Power Station	Cement stabilization	Radioactive waste sludges and soils	Successful	• 250,000 gallons processed
Clinton Power Station	Cement stabilization	Radioactive waste - sludges and resins	Successful	• 25,000 ft^3 processed
Northern Engraving Corp., WI	Cement stabilization	Hazardous soil and sludge	Successful	• Stabilized waste extracts met EP toxicity levels and drinking water standards
Industrial Waste Control Site, AK	Cement stabilization	Hazardous paint and residues and metals	Successful	—
Davie Landfill *(Superfund)*	Cement stabilization	Sludges containing cyanide, lead, etc.	Successful	• 82,158 cubic yards processed in 45 days

STABILIZATION TECHNOLOGY AT NON-DOE SITES

SITE	TECHNOLOGY	WASTE FORM	RESULTS	COMMENTS
Peppers Steel and Allow *(Superfund)*	Cement stabilization	Soil containing lead, arsenic and PCBs	Successful	• Fly ash used as additive • 89,000 cubic yards processed
Sapp Battery and Salvage *(Superfund)*	Cement stabilization	Soils containing lead and mercury	Successful	• Fly ash used as additive • 200,000 cubic yards processed in 18 months
Bio-Ecology, Inc. *(Superfund)*	Cement stabilization	Soils, sludges, and liquids containing metals and VOCs	Successful	• 20,000 cubic yards processed
Independent Nail, SC *(Superfund)*	Cement stabilization	Soils and sludges containing metals	Successful	——
U.S. Plating Company *(Superfund)*	Cement stabilization	Sludges containing metals	Successful	• In situ process
Marathon Steel, AZ *(Superfund)*	Cement stabilization	Soils containing metals	Successful	• Silicates used as additives
Alaska Refinery *(Superfund)*	Cement stabilization	Oil/oil sludges	Successful	• Proprietary ingredient used as additives
Velsical Chemical *(Superfund)*	Cement stabilization	Sludges containing pesticides and organics	Successful	• Kiln dust and proprietary ingredient used as an additive
Chem Refinery, TX	Cement stabilization	Sludges containing metals and oil	Successful	• Proprietary ingredient used as an additive
Lovelace Research Institute	Cement stabilization	Mixed waste - acidic with lesium and plutonium	Successful	• Fifty-six 55-gallon drums were processed • 20,000 containers of contaminated nitric acid wastes
Kirkland Air Force Base	Cement stabilization	Soil contaminated with metals	Successful	• 3,000 pounds of soil were processed • Accepted for disposal at Barnwell
American Airlines, OK	Cement stabilization	Hazardous wastes - spent blast media	Successful	• 4,500 drums were processed
Motorola Products, NM	Cement stabilization	Filter cake containing lead and barium	Successful	• 2,000 - 55 gallon drum were processed
Crestco Site, TX *(Superfund)*	Cement stabilization	Soil, sludge, blast media containing lead and chromium	Successful	• 100 tons processed

STABILIZATION TECHNOLOGY AT NON-DOE SITES

SITE	TECHNOLOGY	WASTE FORM	RESULTS	COMMENTS
Fujiash Industries Ltd. - Japan	Cement stabilization	Industrial waste and dredged spoils	Successful	• Utilized sodium aluminate and sodium alumino silicate as hardener • 720,000 tons of sludge is processed annually
Ebara-Infilco Company - Japan	Cement stabilization	Sludge	Successful	• Sulfates are used as additives
New Orleans Site	Cement stabilization	Glycol waste	Successful	• 4 millions gallons treated • 130,000 gallons/day average (1979)
Polymer Pit Site	Cement stabilization	Liquid/sludges containing organics and inorganics with heavy metals	Successful	• 210,000 gallons processed • 20,000 gallons/day average (1982) • Kiln dust used as additive

STABILIZATION TECHNOLOGY AT DOE SITES*

SITE	TECHNOLOGY	WASTE FORM	RESULTS	COMMENTS
Pantex Plant	Cement stabilization	Mixed waste containing lead	Successful	• 50,000 pounds processed • Project run from 7/91 to 9/91
Savannah River Site	Cement stabilization	Mixed waste	Successful	——
LEHR Site - Davis, CA	Cement stabilization	Radioactive waste	Successful	• Disposal of material at Hanford Site
Savannah River Site - M-Area	Cement stabilization	Mixed waste liquid and sludges	Successful	• 8 million gallons of liquid/sludge processed • 63,000 cubic yards of soil processed • 1988-1989
Brookhaven National Lab	Cement stabilization	Radioactive sludge	Successful	——
Portsmouth Gaseous Diffusion plant	Cement stabilization	Mixed waste - soils	Successful	• In situ processing
Idaho National Engineering Lab	Cement stabilization	Radioactive waste	Successful	——
Oak Ridge Melton Valley Storage Tanks	Cement stabilization	Radioactive waste liquid	Successful	• 47,000 gallons processed • 240 cement formulations created to optimize recipe
Lawrence Livermore National Laboratory	Cement stabilization	Radioactive waste Depleted uranium	Successful	• 200 drums processed
Fermi Laboratory	Cement stabilization	Radioactive waste	Successful	• 850 gallons processed

* These applications are in addition to those reported previously

BACKGROUND PAPER
FERNALD NEPA DOCUMENTATION AND OFF-SITE DISPOSAL

The National Environmental Policy Act (NEPA) was enacted in 1970 and requires federal agencies to consider the environmental consequences of their proposed actions and provide the public a chance to comment. The plan for addressing NEPA for the remedial actions at the Fernald Site were outlined in an Implementation Plan which was issued to the public in 1993. The Implementation Plan was prepared pursuant to DOE's NEPA regulations at 10 CFR 1021. The proposed approach for addressing NEPA at Fernald called for the Feasibility Study/Proposed Plan for Operable Unit 4 (because it was the first FS/PP) to be prepared as an Environmental Impact Statement (EIS) per the requirements of NEPA. This integration of an EIS with the OU 4 FS/PP would require that the evaluation of short- and long-term environmental consequences in the FS be expanded to meet the requirements of NEPA. In addition, NEPA would require the preparation of a cumulative impact analysis and enhancements to the public review process normally carried out under CERCLA. The Record of Decision (ROD) for Operable Unit 4 would also be prepared as an integrated CERCLA/NEPA ROD to meet the requirements of both regulations.

The FS/PP evaluations for the remaining Operable Units would also be prepared as integrated CERCLA/NEPA documents and would "tier" from the Operable Unit 4 FS/PP-EIS. These documents were to be prepared at the level of an Environmental Assessment under NEPA, but were to update the cumulative impact analysis in the Operable Unit 4 EIS. The next integrated document in the schedule was Operable Unit 1 and it was prepared as an EA and discussed the environmental consequences of both the Operable Unit 1 remedial action and provided an update to the cumulative impact analysis originally provided in the Operable Unit 4 document. The remainder of the Operable Unit specific evaluations were to follow suit.

In June of 1994, the Secretary of Energy issued a revised policy for compliance with NEPA. One key aspect of the policy was that in cases where CERCLA and NEPA were being integrated, DOE could rely on the CERCLA process to address the procedural aspects of NEPA (e.g., length of public reviews, filing requirements). However, the substantive aspects of NEPA, such as the evaluation of environmental consequences would still be required. Essentially, the policy had little effect on the integrated evaluations at the Fernald Site as the OU 4 FS/PP-EIS had already been completed. The remainder of the Operable Unit documents were prepared as integrated documents as planned and included the substantive aspects of NEPA such as the updated cumulative impact analysis.

In each of the integrated CERCLA/NEPA evaluations, attempts to identify potential environmental consequences both on and off the FEMP were made. Any aspect of the remediation that involved excavating or disturbing portions of the FEMP (including any sensitive resources such as wetlands) were identified in the integrated documentation. In addition, potential environmental consequences resulting from the transport and disposal of waste at off-site locations were also discussed in the integrated evaluations.

The shipment and disposal of remedial waste generated at the FEMP was evaluated in the integrated CERCLA/NEPA evaluations as follows:

1. OU 4 FS/PP - Environmental Impact Statement (EIS) and integrated ROD (12/94) - This document evaluated the treatment, shipment and disposal of the OU 4 waste material, including risks to workers and the public from transportation of waste and potential impacts at the disposal facilities (i.e., NTS as the selected site and Envirocare as alternative considered). This document also evaluated potential cumulative impacts from the remediation and disposition of all remediation waste generated at the FEMP.

   On two occasions, changes were proposed in the actions presented in the OU 4 FS/PP - EIS. In both cases, a NEPA Supplemental Analysis was prepared to evaluate the proposed changes and help determine what additional NEPA documentation would be necessary. The first Supplemental Analysis was integrated with the OU 4 Container Optimization Study and dealt with the proposed change from rail shipment to truck shipment. The second Supplemental Analysis was integrated with the Silo 3 Alternatives Evaluation which evaluated the change from Vitrification to Stabilization. In both cases, it was concluded that no further NEPA documentation would be necessary.

   It is anticipated that a third Supplemental Analysis will be prepared to evaluate potential changes in treatment technologies for Silos 1 and 2. If new alternatives for the treatment and disposal of Silo 1 and 2 waste are to be considered which are outside the scope of the original EIS, it is possible that a Supplemental EIS will have to be integrated with the new FS/PP and ROD Amendment. This would be an allowable path forward under the NEPA statutory requirements.

2. OU 1 FS/PP & ROD - This integrated CERCLA/NEPA evaluation addressed Waste Pit material going to a Permitted Commercial Disposal Facility (PCDF) by rail for disposal.

3. OU 2 FS/PP & ROD - Also integrated substantive aspects of NEPA. Identified approximately 3,100 cubic yards of material that may not meet the WAC and would be sent to a PCDF.

4. OU 3 integrated RI/FS/PP & ROD - Integrated with substantive aspects of NEPA. (A Proposed Plan supporting the IROD was done as a formal Environmental Assessment under NEPA and a Finding of No Significant Impact (FONSI) was issued, but it only considered the disposition of a small volume of material). The Final OU 3 ROD identified NTS for the disposal of above WAC, non-recyclable material. However, it did mention that disposal could occur at other locations if appropriate NEPA documentation was in place.

5. OU 5 FS/PP & ROD - Integrated NEPA with these evaluations. Indicated that material that does not meet WAC would be shipped to PCDF by rail.

Each of these evaluations do provide some analysis of radiological risks and accident risks associated with transportation. In addition, the cumulative impact analysis is updated in each evaluation and does discuss potential impacts at the disposal locations.

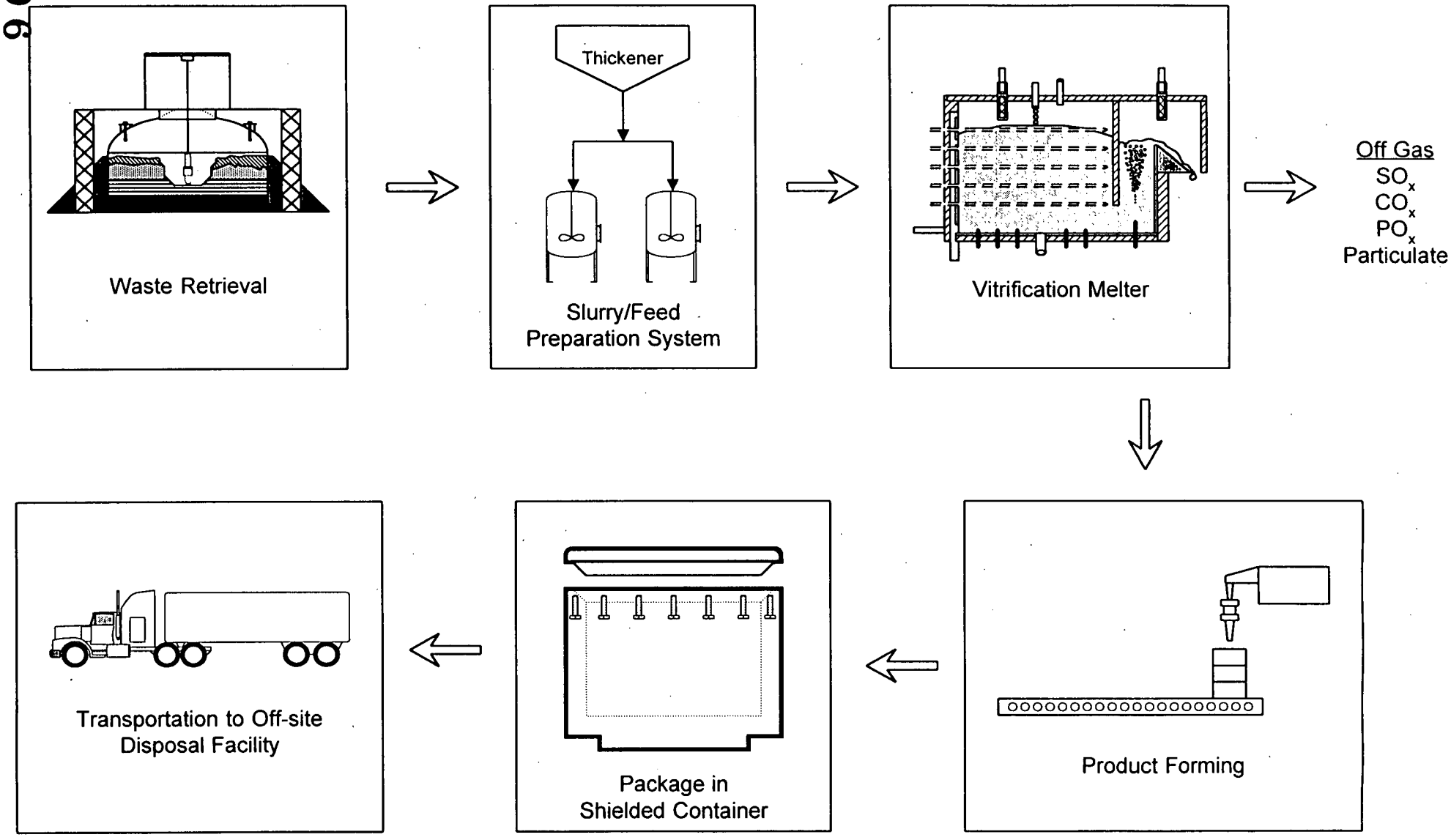
In addition to the integrated CERCLA/NEPA evaluations, other NEPA documentation has been prepared at the Fernald Site to address the management and disposal of legacy waste. For example, CX 455 - Shipment of RCRA Mixed Waste (approved 12/94) addresses the shipment of a variety of RCRA materials (approximately 14,400 cubic feet) for disposal at Envirocare

Summary

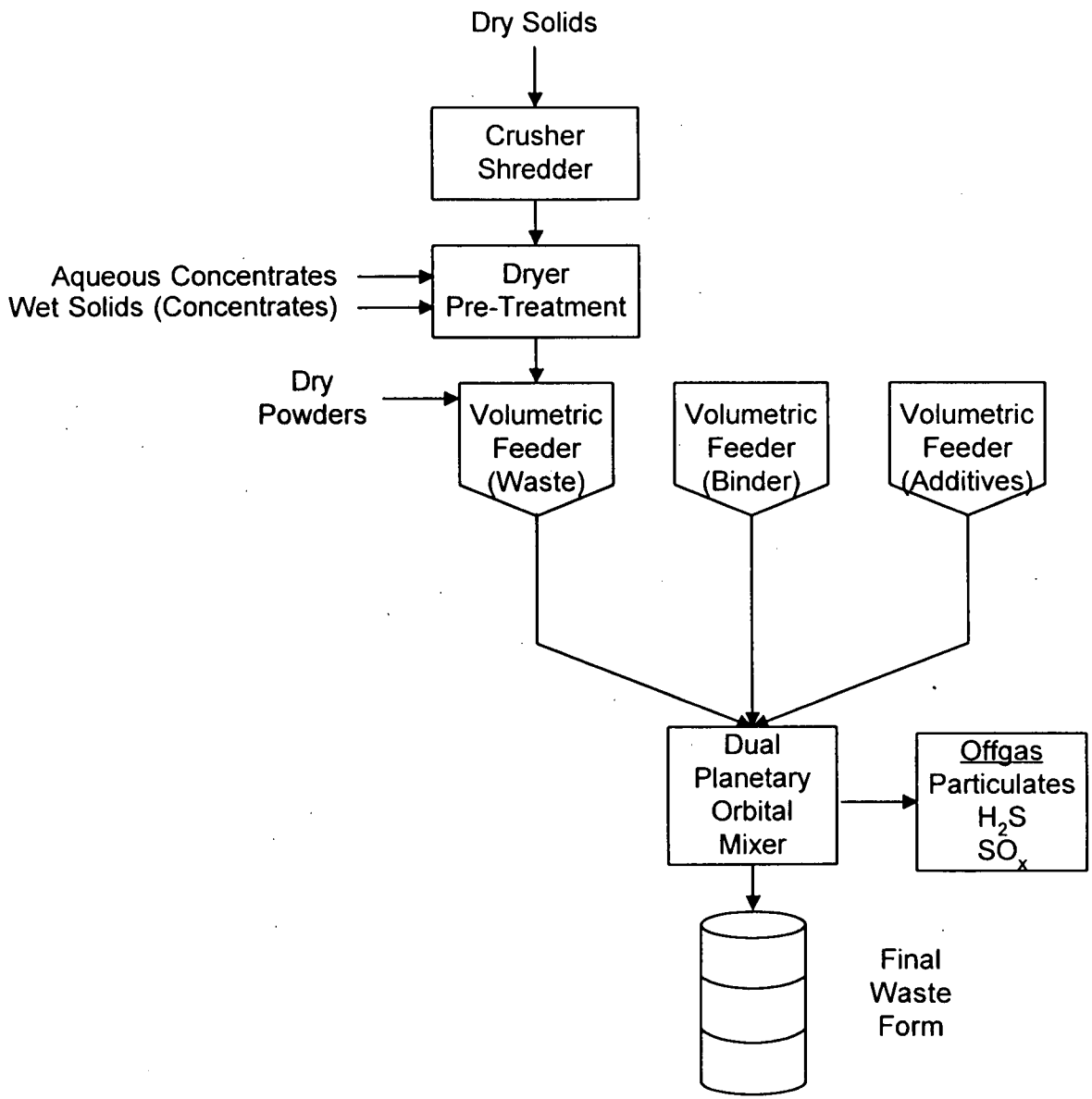
The approach that has been taken to address NEPA for proposed activities at the Fernald Site has been approved by DOE at both the Site Office and the Headquarters level. Extensive discussions with the DOE-HQ NEPA oversight representatives and General Counsel occurred during the scoping and preparation of the integrated NEPA evaluations for the Fernald Site. Clearly we have a defensible position to show that we have met the letter and spirit of the law for proposed actions at the Fernald Site. In addition, all evaluations are consistent with the revised Secretarial Policy and the latest revision of DOE's Implementing Regulations (10 CFR 1021).

OFFGAS TREATMENT COMPARISON FOR SILO 3 TREATMENT ALTERNATIVES

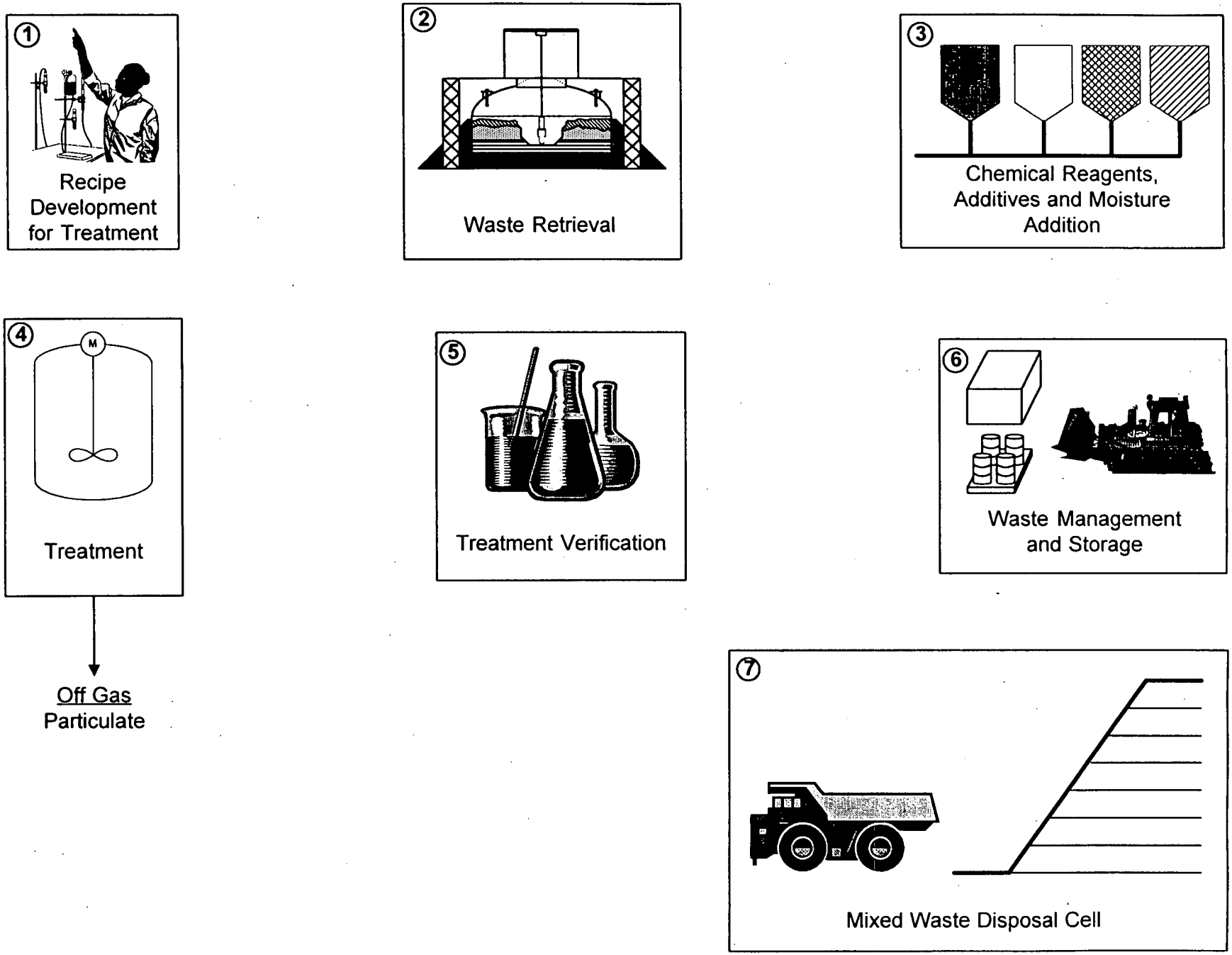
	Cement Stabilization	Polymer (micro) Encapsulation	Sulfur / Polymer Encapsulation
Offgas Issues	Minimal; process maintains moisture in untreated waste, resulting in minimal particulate emissions Offgas system consisting of HEPA filter for particulates.	Minimal; process requires very low moisture content in feed stream resulting in waste particulate generation during material handling Offgas system consisting of HEPA filter for particulates and Carbon Bed for Organic used in encapsulation process.	Greater than cement stabilization or Polymer (micro) encapsulation. Process requires very low moisture content in feed stream resulting in waste particulate generation during material handling. Potential generation of SO_2 and H_2S during process upsets. Offgas system consisting of HEPA filter for particulates and Scrubber for SO_2 and H_2S



Vitrification Flow Diagram

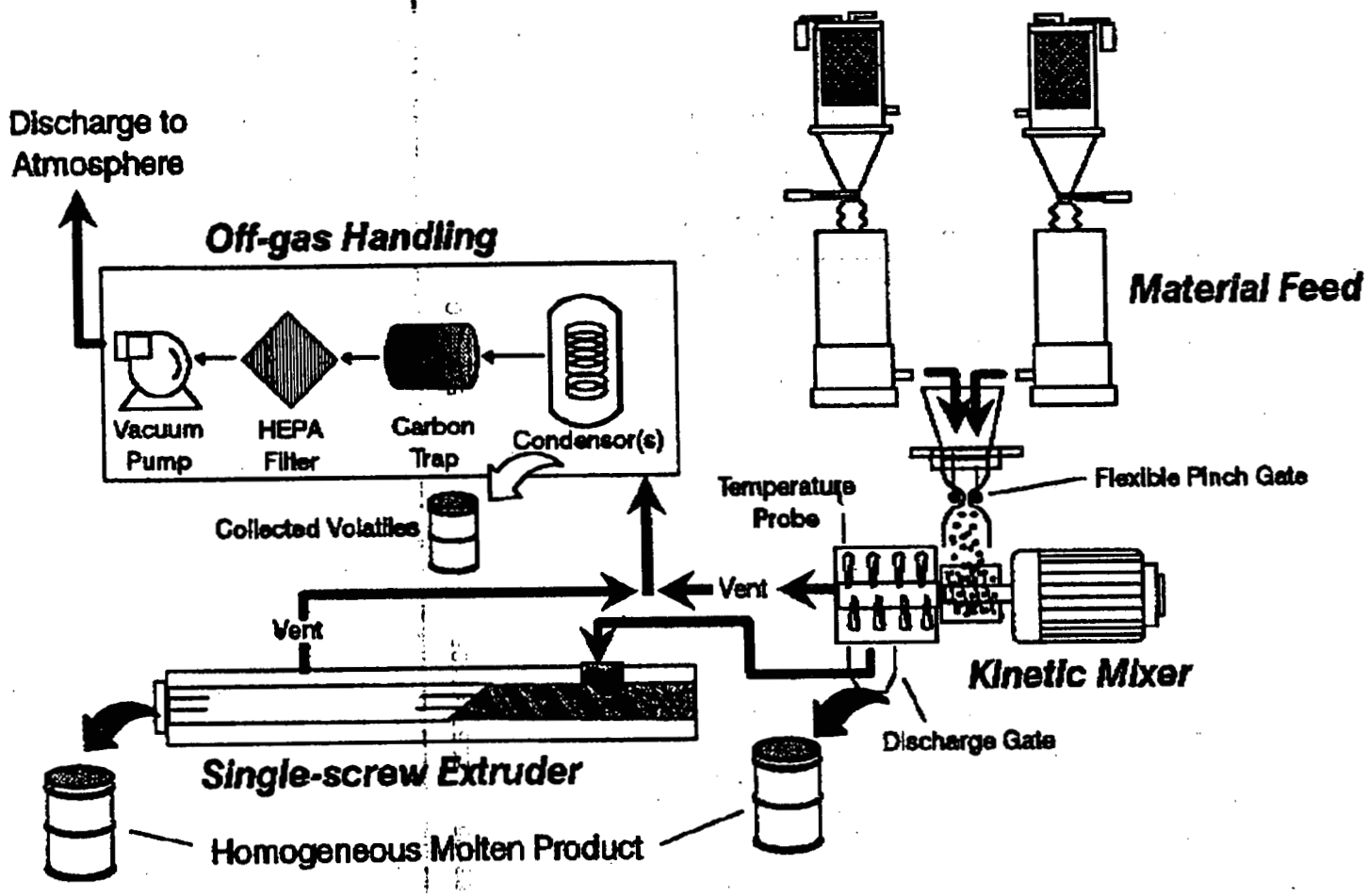


Sulfur Polymer Microencapsulation Process Flow Diagram



Mixed Waste Stabilization Flow Diagram

Polyethylene Microencapsulation Process Flow Diagram



EXPERIENCES WITH CEMENT STABILIZATION

Site	Waste Stream	Treatment Method	Comments	Who
Oak Ridge National Lab (ORNL) Hydrofracture	Liquid Waste - LLW $NaNO_3$ 0.1 -.2M	Solidification Cement Grout Underground Injection.	Successful	Martin Marietta
ORNL Hydrofracture	Suspended Sludge ILW≤ 100ng TRU	Solidification Cement Grout Underground Injection.	Poor QA. Mtg Failures Resulted in Out-of-Spec Injections. DOE Closed Facility in 1984.	Martin Marietta
ORNL Emergency Avoidance Campaign	Liquid LLW 2M $NaNO_3$	Solidification Cement-Slag Matrix. Stored in 55 Gal Drums.	Successful	Martin Marietta
Oak Ridge K-65 Site	Sludge-Mixed Waste	Stabilization/Solidification Cement/Flyash Grout. Mixed in Batch Plant Poured in Drums.	Failure Due to QA. MTG Failure	Martin Marietta
Hanford, WA Site Grout Program	LL Liquid Waste	Stabilization/Solidification Cement-Based Matrix Pumped Into 1.5M Gal Vault	One Successful Campaign with Phosphate Waste. Pgm Canceled in Favor of Vitrification.	Westinghouse
Hanford, WA Site 183 Basins	Saturated Sodium Nitrate Solution. Mixed Waste.	Stabilization/Solidification Mixed in Batch Mixer with Sorbond, a Commercial Stabilizing Material of American Colloid. Mix Placed in Drums.	Drums Bulged DOE. Russ Fed Services in Negotiations with WA Dept of Ecology.	Westinghouse
Rocky Flats Pondcrete Saltcrete	Water, Sediment, LL Saturated Sodium Nitrate Solution. Mixed Waste.	Solidification Neat Cement Mix Poured into Cardboard Box. Solidification Placed in Wooden Boxes Referred to as "Crates" or "½ Crates"	Improper QA. Wrong Equipment, Improper Curing Crates Expanded.	EG&G Oversite - Rockwell International
West Valley, NY	LL Mixed Sodium Nitrate Solution from HLW Processing.	Stabilization/Solidification Cement-Based Matrix.	Successful Approximately 20,000 Drums Stabilized.	Westinghouse
Los Alamos National Lab (TA-55)	Tri-Sodium Nitrate Solution.	Solidification Envirostone-Gypsum Cement	Product Had Bleed Water After 6-8 Wks. Replaced with Portland Cement System. No Additional Problems.	
Weldon Spring, MO Chemical Stabilization System (CSS)	Sludge from Raffinate Pits CERCLA Site.	Solidification Cement/Flyash Matrix. On-Site Disposal Cell.	Dev. Complete Pilot Plant Ops Successful. Production Facility Being Built.	M.K. Fergesun
Savannah River Site (Saltstone)	Approximately 28 wt% Sodium Nitrate Sol of Mixed, LLW.	Stabilization/Solidification Cement/Flyash/Blast Furnace Slag Matrix. Disposal in Onsite Cells.	Successful on Full Scale Test. Feed Stream Dependent on DWPF.	Westinghouse
Fenald Envionmental Management Project Plant 6	2,500 drums Uranium/Thorium waste	Cement grout and placed in white metal boxes	Successfull due to strict adherence to QA. Experienced contractor	Perma-fix
Fenald Envionmental Management Project Thorium Nitrate	7,150 gallons Thorium Nitrate	Neutralized, solidified with cement grout into drums	Successfull due to strict adherence to QA. Experienced contractor	Chem Nuclear