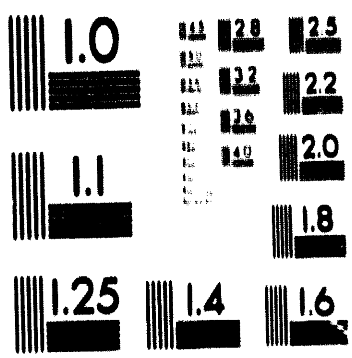
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BENEFICIALLY REUSING LLRW
THE SAVANNAH RIVER SITE STAINLESS STEEL PROGRAM

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THE BENEFICIAL REUSE OF RADIOACTIVELY CONTAMINATED STAINLESS STEEL - THE CREATION OF A NEW INDUSTRY BY THE DOE WITH AN INVESTMENT BY PRIVATE INDUSTRY

1. Background and Summary

In early 1992 there was a need to determine the ultimate disposition of 68 Process Water Heat Exchangers at the Savannah River Site (SRS). Each Heat Exchanger weighed about 100 tons. Since the Heat Exchangers were radioactively contaminated they could be classified as radioactive waste and disposed through shallow land burial on site. The cost for such a disposal would exceed $10 million. The Heat Exchanger material being over 95% 304 stainless steel would represent a commodity value of several million dollars on the commercial scrap market. Unfortunately, the metal is volumetrically contaminated, a situation for which there is no "de minimis free release" level, thereby preventing recycle of the metal into the commercial market place. It was determined however that the metal could be recycled back to the DOE in a "controlled release" manner. Figure 1 displays the "controlled release" scenario. Contaminated metal is reprocessed into new reusable products which are returned to the DOE for use within the DOE Complex. The new products are not used within the public arena. Figure 2 shows the four major functional areas of the process:

1. Cleaning (i.e. decontamination to a level which will allow transportation to and feed into a melter),
2. Sizing (i.e. component disassembly, cutting, etc. to a configuration acceptable at a melting facility),
3. Melting, and
4. Fabrication (of products acceptable to the DOE for use within the DOE Complex).

In general the cleaning and sizing could be performed at DOE or private industry facilities. For the Heat Exchangers it is assumed such activities would be carried out at DOE-SRS facilities since buildings previously used for other work could be made available for this new mission, thereby minimizing total costs. It is envisioned the melting and fabrication portions would be entirely privatized.

In this paper containers for radioactive waste are selected as the fabricated product for evaluation since the concept of using recycled radioactive scrap metal to contain other wastes (rather than add more clean metal to the contamination process) is environmentally attuned. The paper briefly reviews the need for long term temporary storage of radioactive wastes. The merits of stainless steel when compared to carbon steel as container material are discussed. A method of calculating avoided costs is provided. The analysis shows that the avoided costs under reasonable avoided cost scenarios can justify the recycle of radioactive scrap stainless steel. Procurement decisions must include an assessment of total life cycle costs.

It is in the governments interest to promote the creation of a stainless steel Radioactive Scrap Metal (RSM) recycle industry. DOE should take the lead by bringing together the complimentary capabilities of private industry and government. DOE can maximize the pull of private investment by reducing investor risk through the supply of well defined quantities of RSM feed and assuring the purchase of capped quantities of products.

FIGURE 1

Stainless Steel Beneficial Reuse Initiative
(All recycled metal returns to DOE sites)

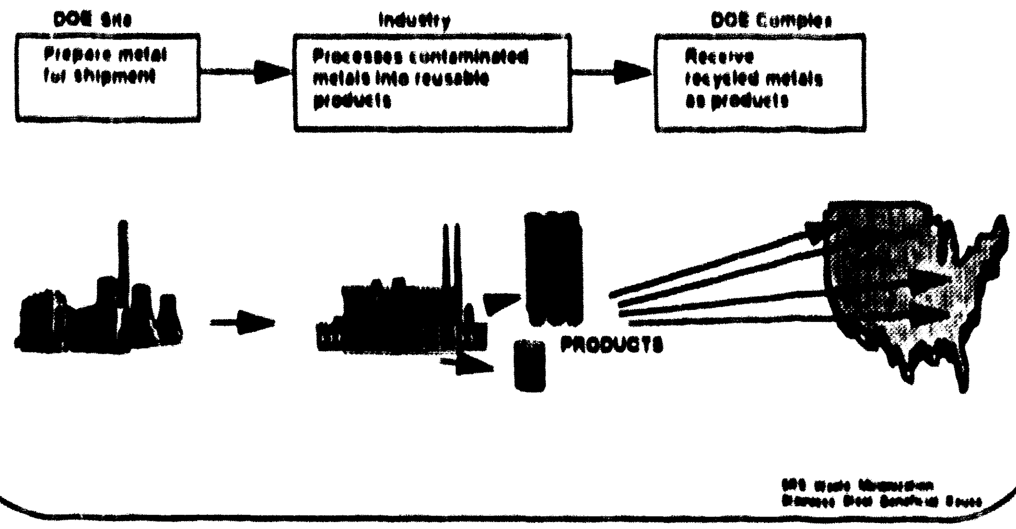
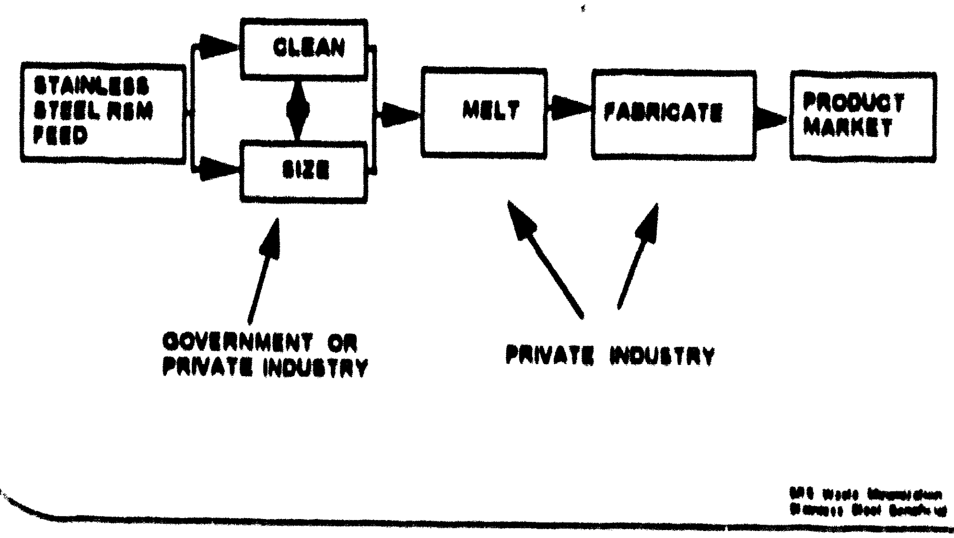


FIGURE 2

MAJOR FUNCTIONS



2. Activities Creating Radioactive Waste

The activities creating radioactive waste can be divided into three categories:

- Decontamination and Decommissioning (D&D) of surplus facilities,
- Reprocessing of waste temporarily stored,
- Continuing normal activities.

Significant amounts of radioactive waste will be generated from activities in each of these categories as described briefly below.

The large number of facilities to be dismantled (DOE, DOD, Commercial Nuclear Industry) is the subject of a number of continuing studies. SRS alone has several hundred buildings containing varying degrees of radioactivity slated for eventual D&D. On a DOE complex wide basis, the number of buildings to be addressed is believed to be in the thousands. The DOD and commercial nuclear industry also have large numbers of buildings and equipment which will require D&D.

A number of the DOE Sites have stored radioactive waste which will require eventual repackaging. Many of the containers of such waste have lost their integrity as a result of the rusting process. SRS has thousands of drums of TRU waste. Other DOE Sites have many thousands of drums which may require reprocessing. In total there are probably several hundred thousand drums of TRU waste throughout the DOE Complex to be repackaged.

Continuing DOE, DOD, and commercial nuclear industry activities will, of course, add annually to the inventory. It is anticipated the DOE complex will generate yearly between 20,000 and 50,000 cubic feet of Transuranic (TRU) waste alone over the next decade as inventories are worked off. As the commercial nuclear industry continues to operate, spent nuclear fuel requiring temporary storage for the 100 power reactors will be generated.

3. Permanent Radioactive Waste Storage Facilities

Permanent disposal facilities are planned for three categories of radioactive wastes: (1) Transuranic (TRU) waste, (2) Spent Nuclear Fuel and High Level Waste, and (3) Low Level Radioactive Waste. It is clear the schedules of many of the permanent disposal facilities are in question and there is need for long term temporary storage. A brief summary of the status of the disposal facilities for these three types of waste follows.

The first permanent storage facility for TRU Waste is the Waste Isolation Pilot Plant (WIPP). In 1987 WIPP was projected to open the following year(DOE/RW-0006 Rev 3) . Today estimates for its opening range from 1995 to some time in the next century. Generators can not package (with certainty) their TRU Waste for eventual disposal at WIPP because of the lack of a WIPP Waste Acceptance Criteria. WIPP is facing delays as a result of continuing environmental-political issues. Until the ultimate disposal resolution occurs, generators are left to do their best in handling their TRU Wastes within the boundary of their own facilities.

The scheduled date for start-up of the first Spent Nuclear Fuel and High Level Waste Repository known as Yucca Mountain has slipped from 1998 to 2003 to 2010 (DOE/RW-0291P, Nov 1990). This proposed depository is facing continuing environmental-political difficulties. Generators must plan to store their High Level Waste and Spent Nuclear Fuel for at least two decades. There is no assurance that any packaging will conform to the yet to be determined Yucca Mountain Waste Acceptance Criteria.

Fees for the disposal of Low Level Radioactive Waste at commercial disposal facilities are passing the $200 per cubic foot value. Utilities are beginning to consider on-site indefinite storage of Low Level Waste (Nucleonics Week, Aug 1992). Illinois rejected the site for its Low Level Radioactive Waste facility, putting its compact into an uncertain future. Low Level Radioactive Waste makes up over 90% of the total volume of all Radioactive Waste. Containers having very long integrity are needed for Low Level Radioactive to avoid periodic repackaging while awaiting permanent storage.

4. The merits of Stainless Steel compared to carbon steel containers.
It is generally accepted that carbon steel containers (i. e. 55 gallon drums) retain their integrity for 10 to 25 years depending on the surrounding environmental conditions. Stainless steel on the other hand will retain its integrity for centuries. If the existing drums (discussed above in Section 2) containing waste had been made of stainless steel, there would be no (integrity related) need to take action on the contained waste until well into the next century or longer. As it stands now, the contained waste will have to be repackaged and, if once again placed into carbon steel containers, the integrity issue will once again develop in another ten or twenty years. The utilization of short term temporary containers creates a decade by decade integrity issue. The use of stainless steel containers would place the integrity issue sufficiently far into the next century so as to allow for the resolution of the permanent facilities (WIPP/Yucca Mountain/Low Level Waste Depository) issues before any action is required relative to the containers. It would be prudent to store any newly generated waste requiring temporary storage, whose ultimate disposition is held captive by environmental-political issues, in containers having proven long term (a century or more) integrity.

5. The false economics of short term integrity, temporary containers.
The following Table displays approximate prices of stainless and carbon steel waste containers.

Item	Price	Price per container weight	Price per contained unit volume
55 Gal. Drum (SS)	$ 150	$4.86/LB	$47.60/cu ft
55 Gal. Drum (CS)	$ 37	$0.63/LB	$ 5.03/cu ft

It is easy to understand why a decision is made to procure carbon steel containers instead of stainless steel containers for temporary storage. As seen in the table above, a carbon steel 55 gallon drum cost $37 while a stainless steel 55 gallon drum costs $350. The carbon steel is comparatively cheap and will last 10 to 25 years, so any problem of rusting can be passed into a different time. When a new container is needed in 10 to 25 years it will only cost $37 anyway. What is overlooked in this thought process is that the initial carbon steel containers after 10 to 25 years will themselves become waste, further adding to the waste stream. The waste carbon steel container may be required to be disposed as the same type of waste it originally contained. Additionally the contained waste must, as a minimum, be repackaged.

Carbon Steel as Low Level Waste.
Disposal of each waste carbon steel 55 gallon will cost $58 (at an estimated cost of $1.00 per pound to dispose of RSM as Low Level Radioactive Waste). In other words, when a decision is made to buy a "temporary" carbon steel container for "only" $37, the buyer is committing the system to spend another $58 to dispose of the drum when it is processed due to its integrity loss; for a total real cost of $95. A stainless steel drum lasting 100 years and a carbon steel drum which has to be replaced every 20 years (5 drums X $95) results in a $475 cost for carbon steel vs. a $350 cost for stainless on a constant dollar basis. One may say the above comparison is faulted , because on a net present value basis carbon steel is still less expensive. However with geometrically increasing disposal costs it is doubtful that simple dollar inflation will fairly present future costs. Also for this situation the repackaging causes radiation exposure to workers in opposition to ALARA principles .

Carbon Steel as Transuranic Waste.
One mechanism being considered throughout the DOE complex to handle buried drums containing TRU waste (which must be dug up), is to place the 55 gallon drums into 85 gallon Overpacks. Assume the Overpacks will be okay to send to WIPP. This will result in an additional 30 gallons per original drum of WIPP space required because of the loss of the original drum integrity. For SRS at a variable life cycle cost of $687 per cubic foot (page 3, WSRC-RP-92-631), the additional cost of the 30 gallons is $2755. For the 17,000 SRS drums the cost attributable to "loss of carbon steel integrity" is an extra disposal cost of $46 million. Attributing the additional cost to the original purchase price of the carbon steel drums, results in the conclusion that when the drums were purchased 10 to 30 years ago for a price of $37, SRS was being committed to spending a additional $2755 for each drum during today's decade. Said another way, SRS thought it was paying only $0.63 per pound for carbon steel drums, but it was actually committing to pay an additional $47 per pound of carbon steel drum. This high price suggests that all Generators of TRU Waste will work hard to reduce volumes sent to WIPP. If one assumes used TRU 55 gallon drums will not be overpacked but will be emptied, crushed to a height of 1.5 inches, and then sent to WIPP for burial; the resulting cost can be reduced to $269 per drum. This is still a high price.

The total cost of disposing of 55 gallon drums when viewed in various forms, as discussed above, is given in the following table.

[illegible]			
	[illegible]	[illegible]	[illegible]
INITIAL DRUM COST	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		
[illegible]		[illegible]	
[illegible]			[illegible]
TOTAL COST	[illegible]	[illegible]	[illegible]

Actual costs will vary by site environmental conditions and reprocessing costs but, the indications are clear: postponing a problem for a decade or two, while waiting for the "ultimate resolution" to occur within the same time period can be expensive when the ultimate solution is not ready as originally planned. The usage of stainless steel instead of carbon steel for temporary waste containers over the past several decades would be paying dividends today. Life cycle costs should be assessed before making low cost short term decisions.

6. The Stainless Steel Beneficial Reuse Industry Initiative

This initiative is directed toward the establishment by the DOE of an industry to recycle radioactively contaminated steel with the participation (including the investment) of private industry. It is envisioned the industry would function as follows.

- Radioactively contaminated stainless steel would be initially processed at the site of origin. The processing could entail as little as the preparation of the metal for transportation to the next facility (if off-site) or as much as decontamination and disassembly into a geometry suitable for feed into a melter. Once processed the metal would then be sent to a Consortium. (The term Consortium is used to generally mean an organization involving private industry.) Any metal which could be free released to the commercial scrap market would be sold at prevailing prices.

- The Consortium will further process the metal, melt the metal, and fabricate products to specifications provided by the DOE. The Consortium could be located on the DOE site or located on land in the vicinity of the site.

- The products fabricated by the Consortium would be returned to the DOE site (or other site within the DOE, DOD, or Commercial Nuclear industry, etc.) for Beneficial Use in a "controlled release" environment.

This Stainless Steel Beneficial Reuse Initiative has several obvious advantages. Waste stainless steel containers can be fabricated for the containment of other wastes, thereby eliminating the need for more clean steel to become contaminated. It creates containers having a life time much longer than the replaced containers. The fabricated (volumetrically contaminated) steel products will be reused in a controlled release market (not released to the general public) thereby eliminating any need to address the lack of a "di minimis allowable regulatory release value" issue. Items made from the waste steel will be able to be contact handled since most of the contamination will be removed as slag in the remelting process. (The radiation one could receive from the fabricated items would most likely be so low as to be immeasurable except by the most sensitive equipment.) This initiative can help to create a new private industry for the recycle of radioactive scrap metal.

7. Beneficial Reuse Stainless Steel Products

One can envision many products using recycled radioactively contaminated steel: (1)containers for radioactive and hazardous waste, (2) rebar for bridges and airport runways, (3) structural material to be used at DOE, DOD and commercial nuclear plants to name a few. The important question is: "how can the industry be nurtured into existence in an economical fashion?" It is believed private industry will invest in the development of the "Recycle Contaminated Scrap Steel Industry" if a guaranteed market for a period of 4 to 7 years can be provided to allow private investors to recover their initial investment.

8. The First Product for the Market

An economically appealing market which can be established by the DOE appears to be the supply of stainless steel waste containers such as 55 gallon drums. There is probably a use for 300,000 to 500,000 such drums throughout the DOE Complex just in this decade. SRS alone could use 40,000 such drums. An acceptable price should be in the $200 to $400 range. This price range is based on the estimated price of other (epoxy coated galvanized carbon steel) TRU type containers under consideration. The market value would therefore have a range of between $60 million and $200 million.

The calculations in this paper use 55 gallon drums as the basis of analysis. Rectangular waste boxes may also be a promising first product. It is important to establish the market with products that can be produced in the large quantities to a fairly liberal specification. Once the market is established then its expansion to products having more stringent requirements (universal spent fuel casks, DWPF canisters, ...) can proceed. Additionally to give the industry its best chance of success, the initial RSM feed stock should be metallurgically constant and well characterized (e.g. the SRS Heat Exchangers) and contain a relatively low level of contamination. The recycling of RSM containing high levels of contamination and the upgrading of contaminated carbon steel using contaminated nickel should be follow-on steps. R & D activities in all areas should move forward to assure the progression of the stainless steel beneficial reuse industry.

9. Price Competitiveness of Beneficially Reused RSM Stainless Steel - Avoided Costs and Indifference Costs

For an industry to survive and grow it must supply its products at competitive prices in the market it serves. In viewing the radioactive waste container market the entire life cycle costs of the containers should be factored into the cost considerations. This is especially important when evaluating products which have different useful life expectancies such as carbon steel and stainless steel containers. Since radioactivity never totally goes away (but just continuously decays to lesser amounts) an initial ground rule that must be established in making cost comparisons is the time period for which the analysis is made. In comparing carbon steel to stainless steel a 100 year period will be used.

Indifference calculations are used to help in making selections between various alternatives. In general, the process is one in which the value of a variable is selected which makes the total cost of two alternatives under consideration the same. (The business person is then said to be "indifferent" to the selection of the alternative since both alternatives cost the same.) One then assesses the reasonableness of the value selected for the "Indifferent Variable". Once one of the alternatives is selected, the costs for the other alternative are not to be incurred and therefore represent "Avoided Costs". In the case of containers to be made from stainless steel RSM, on a purely economic basis, a waste generator would select to use such containers if their life cycle cost is less than the life cycle cost of non-recycled containers.

9.1 Beneficially Reused RSM Stainless Steel Compared to Carbon Steel

The indifference calculation summarized below displays the comparison of the continued use of carbon steel 55 gallon drums with the utilization of beneficially recycled RSM to make stainless steel fabricated 55 gallon drums for the temporary (100 year) storage of LLW. In this example the Indifferent Variable was selected to be the cost to prepare the RSM (68 SRS Heat Exchangers) for entry into the melter.

[illegible]	
ACTIVITY	ESTIMATE
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
TOTAL INDIFFERENCE COST	[illegible]

ALL CONSTANT DOLLARS

[illegible]	
ACTIVITY	ESTIMATE
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
TOTAL AVOIDED COST	[illegible]

The resultant Indifferent (variable) cost for Heat Exchanger Preparation is $50 million. If the Heat Exchanger Preparation is less than $50 million then the cost effective path is the Beneficial Reuse route. If the Preparation is more expensive, then the cost effective path is the carbon steel route. The cost to prepare the Heat Exchangers is expected to be less than $50 million. The cost of the carbon steel route, which includes the cost of burying the heat exchangers as LLW, is avoided. In calculating the carbon steel route it was assumed that carbon steel drums would have to be replaced every twenty years due to their loss of integrity (as a result of rusting). This would cause the purchase of 850,000 carbon steel drums to perform the same function the 170,000 stainless steel drums perform over the 100 year period. The remelt and fabrication costs for the stainless steel drums are set at $4.86/LB which represents a price equivalent to $350 for a drum weighing 72 pounds. This price is believed to be the price a stainless steel remelt and fabrication facility could charge and still make a profit (see Financial Analysis provided elsewhere). For simplicity all values are in constant dollars.

9.2 Beneficially Reused Stainless Steel Compared to Commercial Market Stainless Steel

Based on the above stainless steel versus carbon steel indifference analysis one may conclude to only use stainless steel in the future for indefinite storage applications. However, if one wishes to use beneficially fabricated RSM stainless steel drums it remains to be shown that it is cost efficient to use the beneficially fabricated drums rather than new traditional drums from the commercial stainless steel marketplace. An indifference analysis comparing Beneficially Reusable RSM stainless steel fabricated drums and traditional drums is shown below. The table on the right displays the traditional route, which includes the burial costs for the Heat Exchangers. The table on the left displays the Reuse route, which results in an indifferent preparation cost of $12 million.

INDIFFERENCE COST TO CONVERT [illegible] STAINLESS STEEL HEAT EXCHANGERS TO 170,000 STAINLESS STEEL DRUMS

ACTIVITY	ESTIMATE
INDIFFERENT PREP COST ([illegible])	$12M*
REMELT AND FABRICATION (90%) @ $4.86/LB	$60M
DISPOSAL OF SLAG (10%) @$[illegible]/LB	$ 1M
TOTAL INDIFFERENCE COST	$73M

* INDIFFERENCE COST FOR PREPARATION IS $ 12,000,000 UNDER THIS SCENARIO

COST TO PURCHASE 170,000 "TRADITIONAL" STAINLESS STEEL DRUMS AND DISPOSE OF [illegible] HEAT EXCHANGERS AT [illegible]

ACTIVITY	ESTIMATE
PURCHASE PRICE @ $4.86/LB	$60M
DISPOSAL COST OF HEAT EXCHANGERS @ $[illegible]/LB	$13M
TOTAL AVOIDED COST	$73M

From this one can conclude that if the preparation costs are less than $12 million the Reuse route is the path to follow.

Utilities and industrial companies face larger disposal costs at commercial facilities. For comparison purposes, in the calculation below, costs for disposal of the Heat Exchangers at a commercial facility are estimated. To generate the disposal cost it was assumed a charge of $100 per cubic foot of space at a commercial facility would be levied and the space occupied by each Heat Exchanger would be 42 feet by 9 feet by 9 feet. This results in a total disposal cost of $23 million (or $1.70 /LB). The total avoided cost now becomes $83 million and the indifferent Heat Exchanger preparation cost becomes $23 million (or $1.54/LB).

INDIFFERENCE COST TO CONVERT 60 STAINLESS STEEL HEAT EXCHANGERS TO 170,000 STAINLESS STEEL DRUMS	
ACTIVITY	ESTIMATE
INDIFFERENT PREP COST @ $1.54/LB	$21M*
REMELT AND FABRICATION (90%) @ $[illegible]/LB	$60M
DISPOSAL OF SLAG (10%) @ $1.70/LB	$ 2M
TOTAL INDIFFERENCE COST	$83M

COST TO PURCHASE 170,000 "TRADITIONAL" STAINLESS STEEL DRUMS AND DISPOSE OF 60 HEAT EXCHANGERS AT BARNWELL @ $100/CU FT	
ACTIVITY	ESTIMATE
PURCHASE PRICE @ $[illegible]/LB	$60M
DISPOSAL COST OF HEAT EXCHANGERS @ $1.70/LB**	$23M
TOTAL AVOIDED COST	$83M

* INDIFFERENCE COST FOR PREPARATION IS $ 21,000,000 UNDER THIS SCENARIO

** SPACE REQUIREMENTS FOR EACH HEAT EXCHANGER ASSUMED TO BE 42 FT X 9 FT X 9 FT. THIS RESULTS IN A COST EQUIVALENCY OF $1.70/LB FOR $ 100/CU FT

In the example below the full $220 per cubic foot for Barnwell "out of the Southeast Compact price" has been added to the $60 per cubic foot standard charge for a total of $280 per cubic foot to estimate the high end of the range disposal costs for the Heat Exchangers. This raises the Heat Exchanger disposal cost to $65 million and the total avoided cost to $125 million. The Indifferent Preparation cost now becomes $59 million (or $4.34/LB).

INDIFFERENCE COST TO CONVERT 60 STAINLESS STEEL HEAT EXCHANGERS TO 170,000 STAINLESS STEEL DRUMS	
ACTIVITY	ESTIMATE
INDIFFERENT PREP COST ($4.34/LB)	$59M*
REMELT AND FABRICATION (90%) @ $[illegible]/LB	$60M
DISPOSAL OF SLAG (10%) @ $4.76/LB	$ 6M
TOTAL INDIFFERENCE COST	$125M

COST TO PURCHASE 170,000 "TRADITIONAL" STAINLESS STEEL DRUMS AND DISPOSE OF 60 HEAT EXCHANGERS AT BARNWELL @ $280/CU FT	
ACTIVITY	ESTIMATE
PURCHASE PRICE @ $[illegible]/LB	$60M
DISPOSAL COST OF HEAT EXCHANGERS @ $4.76/LB**	$65M
TOTAL AVOIDED COST	$125M

* INDIFFERENCE COST FOR PREPARATION IS $59,000,000 UNDER THIS SCENARIO

** SPACE REQUIREMENTS FOR EACH HEAT EXCHANGER ASSUMED TO BE 42 FT X 9 FT X 9 FT. THIS RESULTS IN A COST EQUIVALENCY OF $4.76/LB FOR $ 280/CU FT

The avoided disposal cost values estimated in these last examples are more typical of the values commercial nuclear industrial companies face as they evaluate their limited options for LLW disposal in the future. It is recommended such avoided cost values be used as the basis for judgment of the economic merit of the recycle initiative since it is most representative of the real marketplace for the commercial nuclear industry.

There are other avoided cost routes which could be even more costly. For example, if one delays the recycling, is required to bury the Heat Exchangers, and subsequently retrieves the Heat Exchangers for recycle at a later date; it is estimated an additional $40 million (or $3/LB) would be added to the avoided cost scenario.

In the foregoing analyses the "Remelt and Fabrication costs" (in the Indifference calculations) are set equal to the "Purchase Price" (in the Avoided cost calculations). The value used is $4.86/LB, which as stated earlier is the current SRS cost level for delivered stainless steel 55 gallon drums. The validity of the assumption that $4.86/LB represents a price which a private investor would charge has to be addressed. The Pro Forma analysis supporting the Remelt and Fabrication costs assumed the feed radioactive scrap metal would be free to the private investor and would offset the additional costs related to the need to process contaminated metal. The value of uncontaminated feed scrap metal on the free market is in the range of $0.30/LB. This suggests that a pricing level of $4.86/LB could be insufficient to induce an investor into the business.

What then is an appropriate pricing level? The simple answer is that the pricing level will only be determined thorough an iterative process of government/industry engagement during which time information is generated and exchanged, while negotiations proceed. A pricing level sufficient to provide an initial unleveraged return on investment of at least 5% over prime will be necessary to attract the required investors. It is important to keep in mind that the decision to recycle should be based on the entire recycle chain being more economic than the non-recycle chain. Since no single entity in industry has all the capabilities to undertake the process, a Consortium is envisioned. The Consortium will generate its own Pro Forma analysis since it will be investing its own resources.

Government can help reduce the business risk to private industry and private industry can help reduce the risk to government. DOE reduces the risk to industry by assuring a market spanning the "pay back period" of the private investment. The risk to DOE is minimized by the Consortium assuming the business risk of schedule slippage in the construction and operation of the Remelt and Fabrication Facilities. The DOE does not pay for products until delivered to a negotiated specification. The investment risk to DOE is minimized since private industry is investing its capital in the Remelt and Fabrication Facilities. The major investment by DOE is in the Cleaning and Sizing Facility.

10. Need to Assure a market to establish Privatization

Private Industry is willing to take risk when there is a known market which it can serve. Private Industry will risk making a profit in that market. However Private Industry will not speculatively risk establishing the Market when the Market is Government controlled. For this Initiative to be successful the Government must create the Market by committing to buy a given quantity of product to a given specification at a given price. Private Industry will risk its capital if the pricing level is perceived to be reasonable. Once the industry is functioning, the normal forces of supply and demand will dictate pricing levels. The Industry will flourish by producing other products to enlarge the "controlled release" Market.

11. Growing the Industry - Stages of Industry Growth

With the amounts of Radioactive Scrap Metals (RSM) available within the DOE complex it appears likely a flourishing recycle RSM industry of several regional centers is supportable. The industry should probably grow in a number of stages as follows.

- A demonstration facility(s) would be established. The facility(s) would initially receive stainless steel of a single pedigree (e. g. all 304 stainless steel) and fabricate items of the same material. Only a limited type of "conventional" products would be initially fabricated. The products would be manufactured to "moderate" specifications. No significant R&D should be required for the initial operation of the demonstration facility. Development testing to support the initial demonstration facility(s) would be focused on showing private industry their commercial risks are minimum. The products should be usable and have a wide range of general usage within the DOE complex.

- Testing and the development of those technologies necessary to extend the industry beyond present day techniques should proceed in parallel with the establishment of the demonstration facility. Such R&D activities could include: the casting of remelts from dissimilar RSM feeds, casting from "highly contaminated" feed metals, the making of stainless steel from contaminated scrap carbon steel and contaminated nickel, and the application of the technology to other metal types.

- Once the demonstration facility is producing product and ongoing R&D efforts have produced results, private industry would conclude the risk acceptable to establish regional facilities on a competitive basis. The industrial organizations participating in the demonstration facility as well as other groups could form their own private arrangements as they deem appropriate.

12. Availability of Top Grade Feed Metal

To assure the highest probability of success the industry should begin by processing large amounts of scrap stainless steel which is uniform and well characterized from a metallurgical perspective. (In subsequent phases, as the industry becomes established, the creation of quality grade stainless steel from varying types of steel and alloy blending can proceed.) SRS has identified 68 radioactively contaminated scrap Process Water Heat Exchangers. The Heat Exchangers have volumetric tritium contamination, and surface fuel / fission product contamination. Over 95% of the material in these Heat Exchangers is 304 stainless steel. If the 13,000,000 pounds of stainless steel in these Heat Exchangers could be turned into 55 gallon drums, each weighing 72 pounds (with 10% slag), a total of 162,500 drums would be fabricated, with a value in excess of $50,000,000. These drums would have a total containment volume of 8,937,500 gallons (1,190,000 cubic feet).

13. Benefits
the following ar? a number of the benefits that can be ascribed to the Stainless Steel RSM Beneficial Reuse Program.

- Reduces overall DOE funding needed: Through the pull of private industry investment the requirements on DOE budget outlays are reduced. The DOE essentially utilized private investment to help in solving its waste management concerns.

- Creates jobs: The construction as well as the operation of facilities will create jobs, helping in the administration's drive to improve the nation's economy and fulfill the DOE's commitment to support communities that are affected by Defense Industry cutbacks.

- Helps the Economy: The creation of the industry provides a tax base while creating private sector jobs.

- Creates an Environmentally attuned Industry: The concept of using radioactive scrap metal to contain other wastes instead of introducing clean metal to the waste stream is environmentally correct. The initiative establishes beneficial recycle, reduces waste disposal requirements, minimizes the total volume of waste destined for burial and reduces the generation of new wastes.

- Accelerates Significant Beneficial Reuse: With the utilization of the 6800 tons of well defined stainless steel radioactive scrap metal the initiative represents the best opportunity for the near term recycle-fabrication of stainless steel containers. Permits for the testing of radioactively contaminated melts (including tritium) for early phase bench testing are already in place.

- Functions within the current regulatory environment: The initiative accommodates the existing lack of a de minimis volumetric contamination "free release" regulation while economically using radioactive scrap metal in a "controlled release" manner.

- Beneficially uses existing facilities: For the decontamination and disassembly (sometimes referred to as cleaning and sizing) portions of the initiative, existing structures could be used. Permits for the handling of radioactive isotopes (including) tritium are already in place. Any permit modification would be less time consuming and less costly than the processing of new applications.

- Waste minimization: Extends the capacity of existing disposal facilities through the reduction of a waste stream.

- Extends container life: Sites (like SRS) having a high humidity (and the resultant high corrosion) environment have a greater need to eliminate the use of carbon steel storage containers.

- **Reduces DOE risk:** With an assured RSM feed supply and product market, private industry should be willing to risk its investment to construct melt and fabrication facilities. DOE would not be responsible for the schedule slippage costs assumed by industry.

14. Conclusion

It is in the governments interest to promote the creation of a stainless steel RSM recycle industry. DOE should take the lead by bringing together the complimentary capabilities of private industry and government. DOE can maximize the pull of private investment by reducing investor risk through the supply of well defined quantities of RSM feed and assuring the purchase of capped quantities of products. Industry will be called upon to assume the scheduler risks of facility construction, startup, and operation.

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BENEFICIALLY REUSING LLRW
THE SAVANNAH RIVER SITE STAINLESS STEEL PROGRAM

ABSTRACT

With 68 radioactively contaminated excess Process Water Heat Exchangers the Savannah River Site launched its program to turn potential LLRW metal liabilities into assets. Each Heat Exchanger contains approximately 100 tons of 304 Stainless Steel and could be disposed as LLRW by land burial. Instead the 7000 tons of metal will be recycled into LLRW, HLW, and TRU waste containers thereby eliminating the need for near term land disposal and also eliminating the need to add more clean metal to the waste stream. Aspects of the partnership between DOE and Private Industry necessary to accomplish this new mission are described. A life cycle cost analysis associated with past practices of using carbon steel containers to indefinitely store material (contributing to the creation of today's legacy waste problems) is presented. The avoided cost calculations needed to support the economics of the "Indifference" decision process in assessing the Beneficial Reuse option relative to the Burial option are described.

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