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EXECUTIVE SUMMARY

The corporate mission of [redacted] is to enhance environmental quality through contemporary engineering practices. This report outlines SET's response to the Waste-Management Educational Research Consortium's (WERC's) request for the development and demonstration of a process that will retrieve high level radioactive waste from eight underground Single Shell Tanks (SSTs). The tank contents consist of saltcake, sludge and liquid. A characterization of the waste indicates that it is a mixture of sodium nitrate and precipitates of iron, manganese and aluminum. The tank contains unknown levels of alpha, beta and "hard" gamma radionuclides.

SET is proposing that the waste from the eight tanks be retrieved simultaneously rather than sequentially. This significantly reduces the safety risks by eliminating the need to move equipment that has been contaminated with radioactivity. After removal, the retrieval equipment will be left in the tanks. Although there is a small cost advantage favoring sequential removal, simultaneous removal will complete the waste retrieval in approximately four years earlier. The proposed waste retrieval process will cost $10,912,142 and take nine months to complete. An additional twenty-four month period is required for the preparation of an Environmental Impact Statement (EIS) and regulatory permitting. SET designed a telescopic arm based process that utilizes a cutting bit and vacuum system to retrieve the waste from the Single Shelled Tanks (SSTs). The arm based system that SET proposes differs significantly from articulated arm based systems used in the past. SET based the design on existing and commercially available telescopic arms. Telescopic arms are considered stronger and mechanically simpler than articulated arms. A cutting head capable of pulverizing the radioactive waste is placed on the end of the telescopic arm. The arm will be placed inside the SST through an existing 42 in. centrally located manhole. Once inside the tank, the arm will maneuver the cutting head to the waste surface. The pulverized waste will be removed from the tank by a high velocity vacuum incorporated within the arm.

SET proposes a pro-active approach to health and safety. SET's goal is to maintain the site's ground level radiation at background levels. A double seamed radiation tent will be placed over the opening of each tank for precautionary measures. The tent will be equipped with a monitoring system capable of measuring radiation. SET has incorporated special procedures into the operation of the retrieval equipment to insure maximum safety for all site personnel. SET considered legal and regulatory issues, health standards, community concerns and economic obligations in selecting the best alternative recommended to WERC. The proposed design meets WERC's design criteria while minimizing costs.

INTRODUCTION

The corporate mission of [redacted] is to enhance environmental quality through contemporary engineering practices. This report outlines SET's response to WERC's request for a cost effective system that will mobilize and retrieve radioactive wastes in the form of saltcake/sludge from eight single shell tanks (SSTs) that are buried below ground. The radioactive waste needs to be retrieved without compromising the integrity of the 500,000 gallon tanks. A saltcake volume of 350,000 gallons and a sludge volume of 32,000 gallons is contained in each tank[1]. The tanks contain unknown levels of alpha, beta and "hard" gamma emitting radionuclides. The underground tanks also contain debris such as sensor probes, pumps, sluicing jets and steel tapes. Although the debris generally ranges in size from 0.8 m to 3.1 m in diameter, stainless steel tapes 15.8 m long, which were used as level indicators, are also inside the tanks.[2]

The saltcake consists primarily of sodium nitrate which varies in consistency from wet slush to dry masses of large crystals that may contain pockets of liquid. The dried saltcake is a hard, abrasive, brittle material that has physical characteristics similar to the hard salt blocks that are used in the cattle industry. The damp saltcake has a jelly-like form. The bulk density of the saltcake is 1.4 to 1.6 g/cm^3.[1]

The sludge consists primarily of iron, manganese and aluminum precipitates. The sludge has been described as varying in consistency from cream of wheat to peanut butter. It is also sandy with hard chunks of material. Other descriptions of the sludge indicate that it is a thick, sticky, dark brown paste and also a wet, musky solid with no structural strength. The physical properties are listed in Table 1.

TABLE 1. Physical Properties of Sludge[1]

Viscosity	Range 10,000-1,700,000 cp
pH	8.5-13
Specific Gravity	1.25-1.88
Particle Size	9 to 26 μm (0.35 to 1.02 mils) mean by population 50 to 75 μm (1.96 to 2.96 mils) at 50% total by volume

In the absence of "as built" drawings and construction details for the WERC site, SET investigated alternative sources of data. Of the sites investigated that had sufficient data for the design, the tanks at Hanford, WA appear to be the most similar to those at the WERC site. Because of the availability of information and the similarities between the two sites, SET selected the Hanford site as a "model system" on which to base the design.

At the Hanford site, corrosive radioactive waste is stored in 177 underground tanks. Of these tanks, 149 are single shells and 28 have double shells. The tanks are made of mild carbon steel that is encased in reinforced concrete. Each tank has a diameter of 23 m with a 5.5 m high sidewall. The top of the tank consists of a concrete dome lying 2.5 to 3 m below the ground. The side walls are 5.9 m below grade. Each tank has one or more risers that reach from the ground surface into the tank. The largest of the five risers is one that has a diameter of 1.1 m. The main riser is a 1.07

in manhole located in the center of the tank. The thickness of the concrete wall of the tank is 0.15 m. The tanks are structurally sound with no deterioration of the u-bar in the dome. The concrete is also structurally sound with no cracking.[2] Each tank contains a monitoring system (videocamera), a ventilation system, filters, level detection and a temperature thermocouple assembly.[2,4,5]

SELECTION OF OPTIMAL DESIGN

The alternatives that were considered are summarized in Table 2. Seven characteristics were selected for evaluation of the alternatives. The relative importance or valence number (V) of each characteristic was determined by the SET design team. Each alternative was assigned a relative weighting factor (P) based on literature review and discussions with professionals. If an alternative received a zero for any characteristic, it was eliminated from consideration by giving it a total score of zero. The product of the valence number and weighting factor (R) was computed for each characteristic. These values were summed and the alternatives receiving the highest scores (arm based sandblasting, flexible screw conveyor, arm based grinding unit) were evaluated more rigorously.

TABLE 2. Evaluation of Alternatives

	Secondary Waste			Mech / Elect Complexity			Public Relations			Reliability			Safety			Time Factor			Economics			Total
	V	P	R	V	P	R	V	P	R	V	P	R	V	P	R	V	P	R	V	P	R	
Melting	10	10	100	9	8	72	7	5	35	9	0	0	10	0	0	6	5	30	8	4	32	0
In Situ Vitrification	10	10	100	9	9	81	7	8	56	9	0	0	10	0	0	6	6	36	8	7	56	0
Biological Treatment	10	2	20	9	10	90	7	3	21	9	0	0	10	7	70	6	1	6	8	9	72	0
Chemical Treatment	10	1	10	8	10	80	7	4	28	9	1	9	10	6	60	6	4	24	8	9	72	283
Arm based Waterjet	10	3	30	9	8	72	7	6	42	9	7	63	10	8	80	6	7	42	8	7	56	385
Arm Based Sandblaster	10	7	70	9	8	72	7	9	63	9	5	45	10	9	90	6	6	36	8	8	64	440
Flexible Screw Conveyor	10	5	50	9	7	63	7	9	63	9	6	54	10	9	50	6	7	42	8	7	56	458
Umbrella Technique	10	9	90	9	4	36	7	9	63	9	4	36	10	7	70	6	7	42	8	4	32	369
Arm Based Grinding Bit	10	9	90	9	9	83	7	9	63	9	8	72	10	9	90	6	7	42	8	6	48	466

V = Valence Number   P = Weight Factor   R = V x P

The telescoping arm system with a grinding bit was selected for final design because it is mechanically simple, safe to operate, economically feasible, electronically simple, easily transportable and does not generate secondary waste. The potential for mechanical failure is reduced because the arm incorporates fewer parts than any of the other systems.

PROCESS DESIGN

The telescopic arm based process utilizes a cutting bit and vacuum to retrieve the waste from the SSTs (Figure 1). The telescopic arm will be placed inside the SSTs through an existing 42 in. centrally located manhole.[2] Once inside the tank, the arm will maneuver the cutting head to the waste surface. The pulverized waste will be removed from the tank by a high velocity vacuum incorporated within the arm.

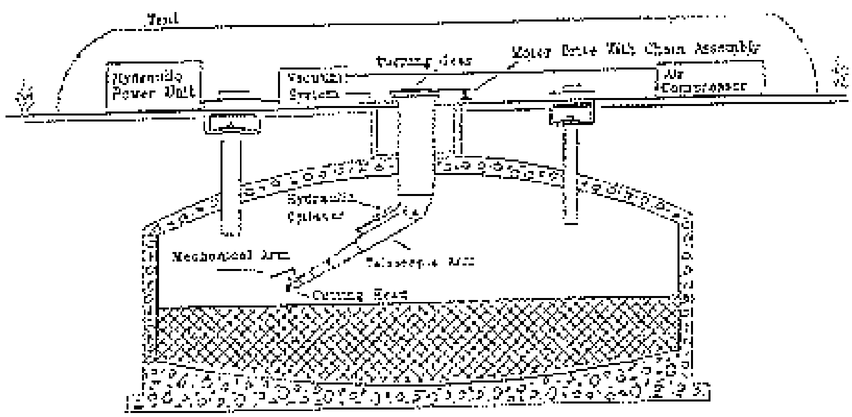

FIGURE 1. Process Schematic

SETs design of the telescopic system is based on commercially available arms. The arm consists of five sections of equal length that can reach a maximum extension of 42 feet. The last four sections of the arm slide within each other. For strength and corrosion resistance, the arm will be constructed of 3/16 in. thick carbon steel. The dimensions of the five sections are detailed in Table 3. To reduce the total weight of the arm, three inch diameter holes on one foot centers are drilled through the sides of last four sections. The weight of the arm and the other parts of the system do not exceed 15 tons.

TABLE 3. Arm Section Details

Arm Section	Length (ft.)	Dimension (in x in)
1	10	8 x 16
2	10	7 5/8 x 15 5/8
3	10	7 1/4 x 15 1/4
4	10	6 7/8 x 14 7/8
5	10	6 1/2 x 14 1/2

The device is controlled by a cable and pulley system mounted on the inside of the arm. The cable is wound around a drum which is driven by a 5 hp hydraulic motor. The hydraulic power is supplied to the motor by a remote pump and valve system. The arm is extended by turning the drum in one direction. By reversing the direction of the drum, the arm is retracted.

The arm is suspended from an externally machined rotating sleeve (40.5 in. O.D. x 38.5 in. I.D. x 120 in. long) placed inside an internally machined pilot sleeve (42 in. O.D. x 41 in. I.D. x 60 in. long). Two inch diameter pins hold it in a manner that allows it to pivot vertically. A gear is mounted to the top of the rotating sleeve. It is chain driven by a 10 hp hydraulic motor. The pilot/rotating sleeve combination facilitates horizontal and circular movement of the arm. Connected to the rotating sleeve is hydraulic cylinder with a 5 in. bore diameter that extends to the first section of the arm. The cylinder controls the angular position of the arm and is powered by the remote pump and valve system.

A 5 hp hydraulic motor is mounted to a hinged plate located at the end of the arm. The motor drives a 8 in. diameter spot rotary grinding bit. The bit has machined carbide grade steel teeth with plates of bor-nitride that are capable of pulverizing the waste. To achieve maximum cutting efficiency SET determined that the shaft of the cutting bit should be held perpendicular to the surface of the waste. A hydraulic cylinder with a 5 in. bore diameter, powered by the remote pump and valve system, controls the vertical position of the shaft.

A monitoring system is attached to the last section of the arm. The system consist of a camera (with self-contained lights), ultrasonic sensor and ground penetrating radar. The camera provides the operator with real time images of the location of the cutting head with respect to the waste and sides of the tank. The ultrasonic sensor produces a computer generated sonar map that will aid the operator if conditions become too dusty for adequate camera images. The radar provides the operator with information about changing waste consistencies (i.e., saltcake to sludge) and alerts the operator when debris is in the path of the cutting bit. A comercial robotic gripping arm that is commercially available is attached to the final section of the telescopic arm. The robotic arm weighs 175 lbs., has a maximum reach of 76 in. and a lift capacity of 1200 lbs. This arm is used to pick up and set aside objects (e.g., steel tapes, pumps, tools and other debris) that interfere with the cutting process. The monitoring and robotic arm system is powered and controlled at a remote location.

A 10 ft. x 10 ft. x 6 in. concrete platform is installed at the entrance of each 42 in. vertical riser. A double seamed radiation tent is erected over the opening of the tank (See Health and Safety for more detail.) The telescopic arm unit is lowered into the tank by a 15 ton (truck mounted) crane and then secured to the platform. The unit effectively seals the riser after it is installed.

The waste is removed from the SST by a high volume vacuum system[12] that operates at 22 in. Hg. A 95 hp compressor pulls the waste through a flexible vacuum hose made of heavy duty abrasion resistant rubber with PVC Helix reinforcing. Sparking, due to static electricity, is limited by using a hose that is high in carbon content which acts as a conductor. It has a diameter of 5 in. and is capable of removing the waste at 30 gal/min. The hose connects to a hood placed around the cutting bit and runs through the inside of the telescopic arm to a cyclone dust separator located on the surface. The vacuum is equipped with a prefilter followed by a double High Efficiency Particulate Air (HEPA) filter. SET incorporated a charcoal filter to capture any volatiles that may be present in the tanks. A high volume air pump is connected to a pressure sensitive monitoring system that automatically adjusts the internal pressures of the tank. The process is designed to maintain a negative pressure of 3 in. of H_2O. This negative pressure reduces the risk of radioactive dust particles escaping by creating an air flow into the tank. The negative pressure design will not compromise the structural integrity of the tank.[13]

The waste retrieval process begins by placing the rotating cutting bit in a position which allows a 3 in. layer of waste to be removed. The gear driven rotating arm is then set into motion. The cutting bit pulverizes the waste as it circles the inside of the tank. If debris is encountered, the cutting will be halted until the robotic arm clears the objects out of the way. After the cutting bit completes the first rotation, it is repositioned and allowed to circle the tank again. The repositioning of the cutting bit is continued until all the waste is removed.

PROTOTYPE DESIGN

For the waste retrieval demonstration, a 55 gallon drum has been cut in half and filled with a saltcake/sludge mixture to simulate conditions at the site. The prototype is mounted on top of the drum (Figure 2) and will retrieve the surrogate mixture in the same manner as the full scale process. SET designed the prototype to be controlled by a single operator.

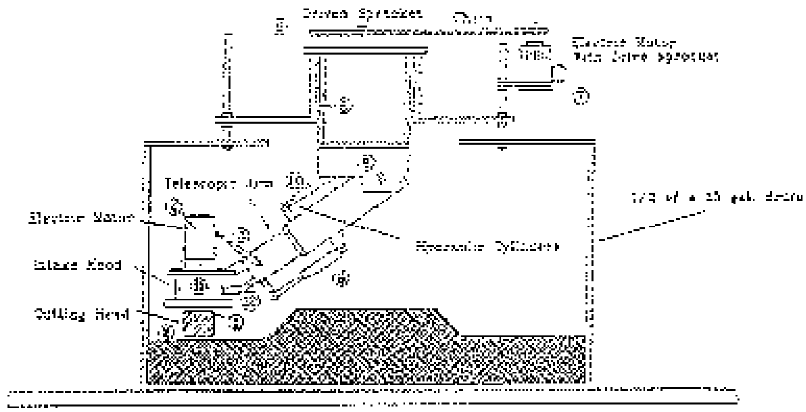

FIGURE 2. Prototype Schematic

The prototype closely resembles the full scale process both in design and functionality. SET determined that the optimum position for cutting is when the shaft of the bit (1) remains perpendicular to the surface of the waste. The design allows the operator to direct the cutting bit (2) to all areas of the drum so complete retrieval of the waste can be accomplished.

The cutting head is maneuvered to the waste via a two stage telescopic arm. A hydraulic cylinder (3) gives the operator control over the position of the cutting bit. The cutting bit is driven by a 1/4 hp motor (4) which is mounted to a hinged plate located at the end of the telescopic arm. A rotating sleeve (5) is placed inside a pilot sleeve to facilitate horizontal, circular movement of the arm. Horizontal control is maintained by a chain driven gear (6) placed on the top of the rotating sleeve. The gear is driven by a 1/4 hp motor (7) equipped with a variable speed control. The arm is attached to the bottom of the rotating sleeve by a pin (8) that allows it to pivot vertically. Hydraulic cylinders control the extension (9) and vertical (10) position of the arm.

Operation of the prototype begins by placing the cutting bit in a position that allows a 1/4 in. deep layer of the waste to be removed. The gear driven rotating sleeve is slowly set in motion directing the cutting bit around the inside of the drum. A hood (11) is placed around the cutting head to help direct the waste to a vacuum (12). The vacuum conveys the waste out of the tank into a container. After the cutting bit automatically completes the first rotation, it is repositioned and allowed to circle the drum again. The repositioning of the cutting bit is continued until all the waste is removed.

METHODS OF TESTING

ANALYTICAL TESTING

Several different designs for the telescopic arm were considered. Based on existing, commercially available telescoping arm units, SET determined that a rectangular shaped design is the most structurally sound. SET analytically tested several sizes of rectangular beams for flexure (Table 4). The testing method included dividing the 45 foot telescoping arm into five sections of equal length with decreasing cross sectional area. A vertical force of 5367 Newton (N) was placed at the end of the smallest section to represent the total weight of the cutting head (1000 N), the external gripper system (1467 N) and the necessary force to overcome the reaction force generated during the cutting process (assumed to be 2900 N). A load ranging between 498.3 and 1464.5 N (depending on the arm area) was placed on each section to represent the its weight. Calculations were based on the full extension of the arm. The values for the modulus of elasticity and density were 2.1 x 105 N/mm^2 and 8 kg/m^3 respectively.

TABLE 4. Estimated total deflection of arm (inches)

	Wall thickness		
Width x Height	1/8 inch	3/16 inch	1/4 inch
8 x 8	16.5	13.4	12.3
8 x 12	7.0	5.9	5.5
8 x 16	3.5	3.2	3.0
8 x 20	2.4	2.2	2.0

The 3/16 in. wall, 8 x 16 in. beam with a vertical bending of 3.2 in. was determined to be the best choice for the design since it is commercially available.

LABORATORY TESTING

In order to determine the most appropriate cutting head for the mediums that will be encountered in the tanks, SET conducted laboratory tests on the saltcake mixture using five different cutting heads (see Figure 3). An abrasive head, an end mill, a metal rasp, a rotary rasp and a wire brush were all tested under the same force and velocities. Under a force of 60 N and a velocity of 2 rps the following data were obtained:

TABLE 5. Salt Cake Removal With Different Cutting Heads

Cutting Tool	Mass Removed (g)	Mass Flow Rate (g/min)	Volume Flow Rate (cm^3/min)
Abrasive Grinding Wheel	3.80	7.60	15.9
End Mill	5.52	11.04	23.1
Metal Rotary File/ Shaver	0.80	1.60	3.4
Metal Rotary File/ Rasp	5.48	10.69	22.9
Wire Brush Wheels	4.80	9.60	20.1

The end mill, metal rotary file/rasp and the wire brush wheels all had similar removal rates. The next step was to test these heads on the sludge mixture. This test was to ensure that the chosen head would continue to function in the sticky consistency of the mixture. The end mill had the least amount of problems working in the sludge medium. It continued to rotate and also brought the sludge up the shaft of the tool. The metal file/rasp's teeth filled with the sludge and it quickly became ineffective. The motor could not remain at the same power input and continue to move in the sludge. The wire brush wheels separated the sludge well, but moved the sludge away from the vacuum.

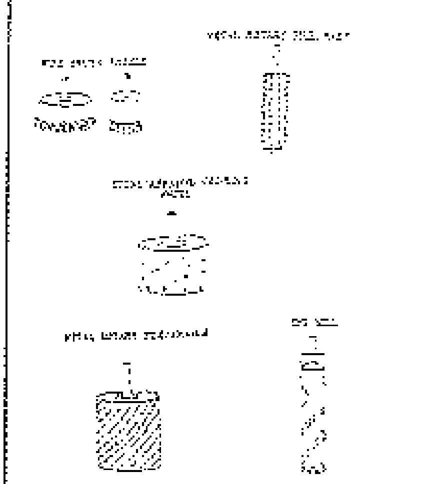

FIGURE 3. Tested Cutting Tools

Based on these experiments, SET selected an end mill for the cutting head. It has the highest rate for breaking up the saltcake, and it will also function in the sludge. The fact that the mill also helps to convey the sludge to the vacuum is also of great importance. The sludge is separated and aerated by the motion of the mill. This reduces the potential for plug flow in the vacuum system.

ECONOMIC ANALYSIS

SET has evaluated two options for waste retrieval: (1) sequential retrieval (by processing one tank at a time), and (2) simultaneous retrieval from all tanks. WERC may choose either option or some intermediate alternative. Simultaneous operation has a labor cost of $4,133,198 and an equipment and operational cost of $6,778,944. Total cost based on a simultaneous operation is $10,912,142. In comparison, sequential retrieval has a labor cost of $6,258,045 and an equipment and operational cost of $3,985,751 with a total cost of $10,243,796. There is a $668,346 cost advantage favoring the sequential operation. However, with simultaneous operation, the waste retrieval process is completed approximately four years earlier than with sequential operation.

Labor costs were divided into two sub-categories, shake down/mobilization/demobilization, and a waste retrieval phase. Since shake down, mobilization, and demobilization are all labor intensive, SET determined that six operators working forty hours per week are needed to perform this phase of the operation. Other necessary personnel include one supervisor, one safety officer, one administrator, and one clerical worker.

SET proposes minimal staffing for the waste retrieval phase of the process. There will be two shifts per day with three operators required for each tank per shift. Each shift will also include supervisors, one safety officer, and one clerical worker. There will also be one administrator working forty hours per week. For the following cost estimates, SET assumed that ground level radiation is at background levels.[19] SET will adjust the number of personnel if measured radiation levels indicate that this is necessary.

TABLE 6. Total Labor Costs For Simultaneous Operation

Shake Down	- 6 months -	$436,602
Mobilization	- 1 month x 8 tanks -	582,136
Waste Retrieval	- 6 months -	2,532,324
Demobilization	- 1 month x 8 tanks -	582,136
Total Costs		$4,133,198

TABLE 7. Total Labor Costs For Sequential Operation

Shake Down	- 6 months -	$436,602
Mobilization	- 1 month x 8 tanks -	582,136
Waste Retrieval	- 48 months -	4,657,171
Demobilization	- 1 month x 8 tanks -	582,136
Total Costs		$6,258,045

The cost of the waste retrieval equipment will be $608,500 per tank application (Table 8). SET minimized equipment costs by using commercially available equipment such as the 15 ton crane, robotic arm, and vacuum unit.

TABLE 8. Equipment Costs

Monitoring Equipment	$128,000[21,22]	Cameras, Geiger counters, ion chambers, etc.
Shielding	40,000[21,22]	Tents w/ double doorway entrance.
Computer System	35,000[23]	Hardware, software.
Vacuum System	75,850[17]	Includes HEPA and charcoal filters.
Telescopic Arm	254,500[24]	Manufacturing, cutting head, robotic arm.
Hydraulic Pump	22,000[25]	Unit cost.
Miscellaneous 10% Total	53,150[26]	Indeterminate expenses
Total	$608,500	

Additional costs for the operation include: energy, employee housing and meals, community relations, compliance audits, the crane, a shielded transport chamber and engineering fees (Table 9). Only one crane is needed for the site. To minimize costs, the crane will be purchased if a sequential operation is implemented and rented if simultaneous retrieval chosen. A shielded transport chamber is necessary to move the contaminated telescopic arm between tanks.[21,22] SET has determined that all equipment will last the life of the operation.

TABLE 9. Cost Comparison Between Sequential and Simultaneous Operations

Sequential Operation Cost		Simultaneous Operation Cost	
Equipment cost	$608,500	Equipment cost x 8	$4,868,000
Crane cost (own)[27]	123,200	Crane (rent 9 months)[27]	36,837
Energy cost	297,907	Energy cost	297,907
Housing and meals	1,392,600	Housing and meals	570,900
Community Relations	420,000	Community Relations	180,000
Compliance audits	324,000	Compliance audits	140,000
Transportation/shipping[28]	5,252	Transportation/shipping[28]	21,008
Transport Chamber	150,000		$6,114,652
	$3,321,459		
Engineering fee	664,292	Engineering fee	664,292
Total	$3,985,751	Total	$6,778,944

BUSINESS PLAN

The retrieval of waste from the tanks will occur in several stages. Figure 4 represents the proposed time schedule for the process.

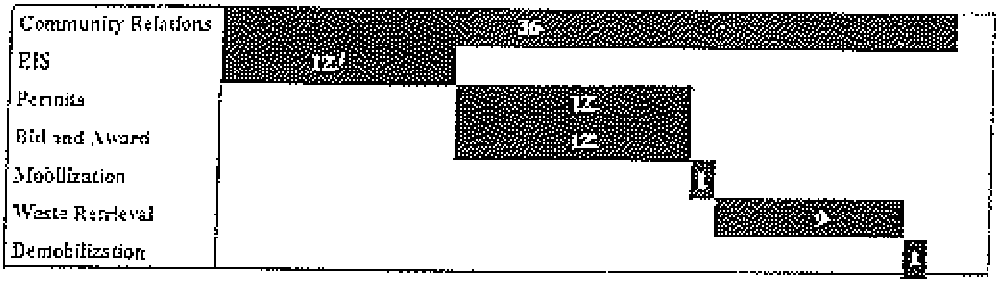

FIGURE 4. Time Schedule For Simultaneous Operation

In the first year after the contract is awarded, an Environmental Impact Statement (EIS) will be prepared. After the completion of the EIS, SET will apply for the necessary permits. This is estimated to require one year. During the Permit phase of the project, SET will solicit bids for the construction of the retrieval equipment. After the equipment has been built, a Shake Down phase will begin. The Shake Down phase will last six months and will include testing and modifications to the original design. The Mobilization phase of the process includes machinery installation and placement. It will last one month. Waste Retrieval will begin immediately after the completion of the Mobilization phase. SET determined that it will take six months to remove the waste from each individual tank. SET proposes a staggered startup to simultaneously retrieve the waste from all eight tanks. Thirty-five months is required for simultaneous retrieval. After the waste is removed from the tanks, a one month Demobilization phase will begin. The community relations program proposed by SET will be on-going throughout the entire process and will continue for one month after completion of the operation.

SET offers WERC other time schedule alternatives based on sequential waste retrieval from individual tanks. Figure 5 shows the time schedule based on a single unit operation. Other time schedules can be implemented based on the specified number of working units requested by WERC. The time required for waste removal from each tank will remain at six months. A one month period will be needed for the removal and transfer of the equipment between tanks. Removing the waste from all eight tanks sequentially will require a total of fifty-five months.[1]

[1] As per section 3.21 of the Memorandum of December 2, 1995 from Dr. Abbas Ghassemi of WERC stating that "The system shall be designed to retrieve a full tank of waste in six to twelve months."

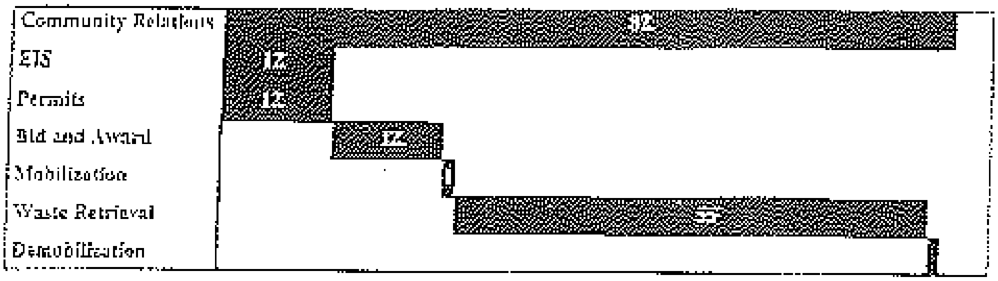

FIGURE 5. Time Schedule For Sequential Operation

LEGAL AND REGULATORY CONSIDERATIONS

The proposed remedial action for the waste retrieval process will be accomplished in compliance with the applicable federal, state and local regulations. The major statues that will affect the removal process are the Atomic Energy Act (AEA), the National Environmental Policy Act (NEPA), and the Occupational Safety and Health Act (OSHA). Occupational safety is of significant concern and is discussed in detail in the Health and Safety segment of this report.

Under the provisions of AEA, the Nuclear Regulatory Commission (NRC) is responsible for licensing and regulating the receipt, transfer, possession, and disposal of by-product, source, and special nuclear material. Requirements for notices, instructions, and reports to workers are established in 10 CFR 19. Standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC are established in 10 CFR 20. The storage, transport, and disposal of the waste material that is removed from the tanks will be accomplished in accordance with the applicable regulations set forth in 10 CFR 20.

Title I of NEPA of 1969 establishes a national environmental policy, methods for accomplishment, and relates NEPA to other federal laws. One of the most important aspects of NEPA is that it outlines the requirements for an Environmental Impact Statement (EIS). An EIS is required when the proposed process is a major action, the proposed site is federal, and when there is significant environmental impact resulting from the process. Activities at the site will be designated as federal actions under NEPA if the remediation site is a federal facility that is contractor operated. Since it is our understanding that the WERC site is a federal facility that is contractor operated, SET believes that it would be prudent to have an EIS.

Since there will be no generation of polluted air or water during the removal of the waste, this project will be exempt from the Clean Air Act (CAA) and Clean Water Act (CWA) regulations. Underground storage tank (USTs) systems containing radioactive materials that are regulated under AEA are deferred from compliance with UST rules (40 CFR 280.10).

HEALTH AND SAFETY

SET proposes a pro-active approach to health and safety issues at the retrieval site as well as in the nearby communities. Safety training will be provided to all employees involved with removing the waste. Training Right-To-Know regulations, radiation safety, the use of Material Safety Data Sheets (MSDS's), emergency response, and equipment operation will be conducted and documented. Periodic radiation surveys will be conducted throughout the site.

SET will ensure that health and safety of the employees and the community through the use of specially-designed procedures. SET proposes that a double seamed radiation tent be erected over the opening of each tank. The entrance to the tent will be a four stage vestibule equipped with a decontamination room. An Air Particulate Detector (APD) will be placed in front and in back of the filters to aid in the detection of any airborne radioactive particles. The excess air produced by the vacuum will pass through a pre-filter equipped with a double HEPA filter followed by a charcoal filter. Six ion detection chambers will be strategically placed throughout the inside of the tent. Two cameras will visually monitor the operation. The monitoring of the tent system will be performed by two Programmable Logic Control (PLC) units, each capable of monitoring of the system alone. Systems status will be visible at a remote monitor screen. Any site potentially containing airborne radiation will bear a WERC posting with the radiation symbol and the words "CAUTION, AIRBORNE RADIOACTIVITY AREA."

The retrieval process that SET has proposed is designed to run remotely. However, SET realizes that occasionally there will be a need to enter the tent for maintenance and inspection purposes. Entrance into the tent will be controlled. The arm system will have a locking device to stop operation of the equipment if personnel enter the tent. The vacuum hoses will be evacuated by a blow-back procedure to reduce the risk of a "hot" plug of saltcake being present in the hoses. The operator will be clothed in appropriate attire (Level A, Self Contained Breathing Apparatus) and carry hand-held radiation measuring devices. The process will not continue until all personnel have left the tent.

OSHA regulations will be followed for all on-site operations of machinery used during the waste removal. Where required, protective equipment will be used for all persons working at the site. Special precautions will be made to prevent sunstroke and heat exhaustion due to the desert climate. There will be a qualified safety officer on site during the removal of the waste. In case of emergency, the site safety officer will be alerted and if necessary alert the NRC. First-aid kits and proper emergency media will be located on site. Local Fire Departments will be issued copies of the MSDS forms for the site to ensure proper response in case of emergency. SET will also devise an emergency evacuation plan for the site and the surrounding areas.

Through the methods previously discussed, WERC will ensure that the total effective dose to the employees and public are as low as is reasonably achievable (ALARA) and do not exceed the standards documented in 10 CFR 20.1201 (a1). The radiation protection program will be reviewed at least annually. Through this program, WERC will ensure that the average annual concentration of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in 10 CFR 20.1001-20.2401 (Table 2, Appendix B). Records pertaining to the radiation protection program will be maintained until the NRC terminates WERC's license.

COMMUNITY RELATIONS

Upon acceptance of the proposal, SET suggests the formation of a policy advisory committee and a technical advisory committee. The primary purpose of the Community Relations Committees (CRC) will be to establish communication between SET, WERC, and the community. The CRC will address the concerns of the general public and recommend possible changes in the retrieval process. SET also recommends that WERC hire a public relations professional to help with the coordination of the CRC and other community related activities.

SET proposes that the policy advisory committee consist of: Las Cruces Mayor, Ruben Smith; acting New Mexico State University President, William B. Conroy; Sierra Club President, Myra Price; Las Cruces Sun News Editor, Harold Cousland; one representative from WERC; and two representatives from the local community. The primary role of this CRC panel will be to hear and evaluate public concerns relating to the waste retrieval project and to provide written comments to SET.

A technical advisory CRC will review the proposals submitted by SET and provide written comments documenting the committee's concerns. This CRC should include: Las Cruces Public Works Director, Ken Needham; WERC Director, Abbas Ghassemi; an NRC Radiation Safety Officer; a Department of Energy representative; and an Environmental Protection Agency representative.

The CRC will coordinate informal town hearings to disseminate general information about the project as soon as possible after the contract is awarded. Additional hearings will be held regularly throughout the removal project to keep the public informed. Presentations in Spanish and sign language will be provided, as well as presentations to identified stake holders.

At the proposed hearings and throughout the community relations plan, SET will emphasize the following issues:

- Routine monitoring of air, soil, groundwater and any wastes that are generated,
- Appropriate shielding against radiation,
- Protection of employee and public safety during the waste retrieval operation.

Throughout the retrieval process, SET and WERC will cooperate with all federal, state, and local authorities. SET will also use a computer-generated model of the retrieval system to reconcile the physical constraints of the retrieval with the concerns of citizens groups and government officials (Pinder, et al.).

To answer community questions, SET will sponsor a toll-free hotline, and a kiosk. There will be a separate toll-free number for Spanish-speaking individuals and a teletypewriter (TTY) for the hearing impaired. The kiosk will be located in the Las Cruces Museum of Natural History at Mesilla Valley Mall and will provide information describing the retrieval process and its relationship to the community. The toll-free hotline number will be staffed by trained personnel who will respond to any questions and concerns voiced by members of the community. The CRC will also sponsor an open house to discuss the retrieval endeavor with the public.

CONCLUSION

SET developed an economic, innovative telescopic arm based system that utilizes a cutting head and a vacuum to remove radioactive waste from underground SSTs . We believe the proposed design meets or exceeds all of WERC's criteria in an environmentally sound manner that may be implemented with maximum community support. SET looks forward to the opportunity of working with WERC on this challenging project.

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