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DWTF ASSESSMENT

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Science Applications International Corporation

October 6, 1986

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Science Applications International Corporation

October 6, 1986

Richard M. Alire, L-326
Lawrence Livermore National Laboratory
P.O. Box 808
Livermore, California 94550

Re: DWTF Assessment - Pursuant to Purchase Order #9495105 (August 14, 1986)

Dear Dick:

This letter report is submitted to summarize the status of the DWTF assessment as of this date. Please consider it as a draft document since we hope to be able to obtain improved information on some of the cost figures and on scoping estimates for the facility. Any improved estimates will be incorporated in our final report to be submitted at a later date. Unfortunately, the time available to do this work has been short and we have not been able to complete all of the investigations and study we had hoped to. However, the information, insights, and recommendations contained herein may prove helpful to you at this time.

Study Objectives - The purpose of this study has been to evaluate the adequacy of present and proposed decontamination and waste treatment facilities (DWTF) at LLNL, to determine the cost effectiveness for proposed improvements, and possible alternatives for accomplishing these improvements. To the extent possible, we have also looked at some of the proposed environmental compliance and cleanup (ECC) projects.

Approach - To obtain the data and information required to accomplish the above objectives, the following was done:

- Review of existing available documentation including:
 - The DWTF Conceptual Design Report (CDR) dated March 1985, by Holmes and Narver, Inc. Particular attention was devoted to Appendix G of this report on "Process Development" produced by A. D. Little, Inc., containing justification for the DWTF.
 - The draft "Environmental Compliance and Cleanup" report dated March 1986.
 - Report on DWTF options by Art Maimoni dated June 1986.
 - Memos on Toxic Waste Reduction by J. W. Dini (9-23-86) and E. A. Lafranchi (8-26-86).

Unfortunately, ~~we~~^{we} have been unable, as yet, to obtain a draft copy of the Environmental Assessment of the DWTF being prepared by Radian Corp.

- A survey form on the DWTF was distributed to cognizant LLNL personnel to obtain their views on the justification for various proposed operational improvements. A copy of the survey and a list of recipients is presented in Appendix A. (Note: the response has been less than enthusiastic, but we were able to get a few interesting insights.)
- Interviews were held with certain LLNL personnel to obtain more detailed information and insight on the need for DWTF improvements. Interviewees included: R. Salazar, R. Quong, S. Jackson, B. F. Musgrave, R. Latimer, J. Landrum, R. Heckman, M. Coops, I. Meisel, and R. Deschene. We have not, as yet, had the opportunity of discussing the DWTF with R. Ragaini, or any of the legal staff.

- Periodic meetings were held with Paul Meagher to coordinate with the ECC study and with your review committee to assess progress on our study.

DWTF Overview - From our review of documentation on the DWTF and discussions with cognizant personnel, it is apparent that many improvements in current decontamination and waste treatment facilities at LLNL are justified. However, there remain some questions on certain aspects of the proposed DWTF. These questions regard: (1) whether certain features of the DWTF such as the incinerator, laundry, and onsite laboratory are necessary, and (2) whether the design scale of certain operations is justified. For example, we have some questions regarding whether projected quantities of solid and liquid waste streams are accurate to begin with and whether programmatic efforts to minimize the quantities of waste generated might not prove more cost effective than providing large scale capacity to handle projected volumes.

Possibly the most complete summary of rationale for the DWTF is presented in Appendix G of the CDR. We find this rationale, in itself, to be less than convincing. Appendix B presents this rationale along with our commentary on it. Some reasons pointed out include: (1) environmental rules and regulations will become increasingly stringent, (2) DWTF operations can best be conducted at LLNL by lab personnel as opposed to contracting this work to others, and (3) there is a need to reduce environmental "risks" from DWTF operations. This rationale appears to be largely conjectural and therefore the need for and extent of the DWTF improvements are, to a large degree, judgmental. An exception to this point would be where a clear violation of existing law, rules, or regulations can be identified, such as those cited in California State DHS document CA 2890012584. We have attempted to match specific non-compliances with specific DWTF improvements and have not been entirely successful. Nonetheless, it generally appears that the DWTF is justified, although some of the proposed improvements may not be necessary.

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One example is the proposed incinerator facility. Appendix C presents a scoping assessment of the possibility for offsite shipment of LLNL combustible waste for processing at another DOE facility. From this assessment it is likely that offsite incineration could prove to be cost effective provided regulatory and administrative hurdles can be overcome.

A summary of our views on the necessity for specific DWTF improvements, based on our review is presented in Table 1. It should be noted that this summary does not address the question of scale in detail. For example, although it is clear that improvement in liquid waste handling facilities are probably justified, we have serious questions on two related points:

1. The projected volume of liquid waste to be treated appear (in some instances) to be high. We have spot checked some of the figures and believe them to be excessive; however, it is difficult to determine all the assumptions and methods used in deriving the projections. For example, there is nearly an order of magnitude difference in projected volumes for metal solution waste (the single largest wastestream) between UCRL-20209 (Heckman report), the Radian report, and the Dini and Lafrachi memos. I checked with the plating shop and fab shop directly and found the latter estimates (the lowest estimate) to agree with the generators estimate. According to the CDR, the highest estimate provides the design basis. Further investigation is certainly indicated.
2. There is a good possibility that efforts to reduce waste volumes at their point of generation could result in significantly lower waste volumes with concomitant reduction in the required scale for the proposed DWTF facilities.

ECC Overview - Unfortunately, we've not had time to look into ECC projects in any detail other than to discuss them with Paul Meagher and to review his

Table 1

REVIEW OF PROPOSED DWTF OPERATIONS

DWTF Operation	Comment
Decontamination	Improvements are required primarily for occupational health and safety reasons. However, proposed facility can probably be downscaled. It is possible that decontamination of many items is currently not cost-effective. This point should be explored.
Solid Waste Receiving, Classification, and Processing	Proposed improvements appear to be justified.
Liquid Waste Processing	Improvements are justified. However, there is a good possibility for downscaling. Offsite processing provides another possibility.
Burn Pan	Probably justified (we have not looked into this item to any significant extent).
Analytical Laboratory	Work could probably be done at other (existing) LLNL laboratory provided it was a "dedicated" facility (i.e., under DWTF control).
Incinerator	Probably not justified. If processing could be done offsite at another DOE facility for example.
Laundry	Not justified. We could find no good reason not to continue offsite (contracted) laundry.
Support Facilities	Justified.

report. This report provides an interesting analysis of the opinions of cognizant LLNL personnel and provides some very useful insights on regulatory implications for the proposed ECC projects. We offer one caution in utilizing the ranking information for prioritization purposes. An important consideration in assessing the priority for such projects is an evaluation of its probable success. Regardless of the desirability of the objective, if the proposed project has little probability of achieving that objective, it should have a lower priority. A case-in-point to consider is the proposed groundwater cleanup.

Discussion and Conclusions - Based upon our assessment, to date, we offer the following discussion and conclusions:

- In exploring rationale for the DWTF, we find that the motivations and incentives are complex with little uniformity of view among cognizant individuals. Some have expressed the belief that DWTF improvements are needed to reduce environmental risk. Others believe the facility is needed for operational efficiency. The latter view is more consistent with our opinion.
- From environmental monitoring data we have reviewed, it is apparent the environmental risks associated with the DWTF are already so low that cost effective risk reduction would be extremely unlikely. Therefore, application of cost/benefit analysis as a tool for evaluating cost effectiveness of DWTF improvements is untenable.
- Although environmental risks are already very low, information from Hazards Control indicates that occupational risks associated with DWTF operations need to be reduced. It appears likely that industrial hygiene improvements could be justified on that basis.

- We suggest that reasonable objectives in DWTF design objectives should include:
 - Correction of identified non-compliances with rules and regulations.
 - Correction of noted industrial hygiene problems.
 - Improvement of operational efficiency.
 - Implementing the above at minimum possible cost.
- Before proceeding with title 2 design, we suggest a consideration of possible downscaling certain operations. We also suggest that maximum flexibility be maintained in the facility design to facilitate future implementation of improvements, when indicated; and deletion of operations no longer needed.

I hope you find this helpful.

Sincerely yours,

Jerry J. Cohen

JJC/ps
enclosures

APPENDIX A

Science Applications International Corporation

September 8, 1986

Dear :

The rationale and requirements for the proposed Decontamination and Waste Treatment Facility (DWTF) for LLNL is under review by a committee chaired by Dick Alire. Science Applications International Corporation is under contract to assist in this review. As part of our evaluation, we need to catalog the rationale supporting or opposing the need for the proposed improvements and additions to existing waste treatment operations which will comprise the DWTF.

The proposed DWTF operations include:

- Decontamination
- Dry Waste processing
- Liquid Waste processing
- Analytical Laboratory
- Solid Waste Receiving and Classification
- Burn Pan
- Incinerator
- Support facilities
- Laundry
- Other ..

We request your assistance in this effort by completing the accompanying questionnaire. Please supply us with the information you have regarding the proposed operations by:

duplicating the form for as many operations on which you are able to comment

marking in the space provided the name of the operation on which you are commenting

completing the forms.

Please return the completed forms to me at our Pleasanton office as soon as possible, preferably within the next week. In addition to the written material you submit, it may be necessary for us to contact you to discuss details. We are particularly interested in learning of any operational deficiencies or non-compliance with specific laws, regulations, DOE orders, etc., which have dictated the need for each of the proposed DWTF operations.

Survey Letter (continued)
Page 2

We appreciate your help. If you have any questions, please call me or
Craig Smith at 462-5300.

Sincerely,

Craig Smith
for Jerry Cohen

JJC:mg
enclosure

SURVEY FORM

Proposed DWTF Operation: _____

What is the rationale for the improvements or additions (e.g., correction of non-compliance, operational improvement, etc.)?

If non-compliance, please indicate the nature of the non-compliance and cite the specific law/regulation/order:

Is the non-compliance clear and unequivocal or is it subject to interpretation (technical, legal or administrative)?

What do you believe the consequences would be if this proposed change is not made?

What is your overall opinion regarding the need for this proposed change?

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Richard Ragaini
Robert Salazar
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Arthur Toy
Janet Tulk

APPENDIX B

Comments on Rationale for DWTF

A summary of rationale for the DWTF is given in Appendix G of the Conceptual Design Report (CDR). Appendix B-1 provides a copy of this rationale. Comments pertain to outline designation number.

Comments

1. Re 1.1.2 - The fact that present facilities do not meet RCRA regulations is a key issue in justifying the DWTF. Accordingly, it would be useful to know what the specific non-compliances with RCRA are, to what extent present facilities are out of compliance, and conceptually what it would take to bring them into compliance. We could not find this information in the CDR.
2. Re 1.1.3 - it is not clear as to why onsite LLNL personnel would be more "dedicated to handling waste in an environmentally safe manner" than would an offsite toxic waste handler whose entire business is devoted to that function.
3. Re 1.1.5 - The idea that environmental rules and regulations will "undoubtedly become more stringent" in the future is conjectural. One could also make a case that they will become less stringent as the public and legislative bodies came to realize that such rules and regulations have little or no beneficial effect on public health.
4. Re 1.1.6 - No mention is made of the possible cost effectiveness (or lack thereof) for achieving the "lowest possible risk". It is axiomatic that regardless of how low any risk is, it can always be further reduced by expending further resources toward that goal. Where do you stop?

APPENDIX B-1

From: Conceptual Design Report on DWTF

1. SUMMARY

1.1 This report presents the results of an evaluation of the present Toxic Waste Control Operations at the Lawrence Livermore National Laboratory, evaluates the technologies most applicable to the treatment of toxic and hazardous wastes and presents conceptual designs of processes for the installation of a new decontamination and waste treatment facility (DWTF) for future treatment of these wastes. The findings and recommendations of this study are as follows:

1.1.1 LLNL generates a great diversity of hazardous wastes in small to medium quantities that require flexible equipment and knowledgeable personnel in order to meet governmental regulations.

①

1.1.2 The present Toxic Waste Control Facility uses well established technologies for decontamination and treatment; however, the facility is not capable of meeting RCRA regulations for a Hazardous Waste Management facility, is constrained in layout and size and needs improvement in operability.

②

1.1.3 The relatively large fraction of the Toxic Wastes that are currently shipped off-site means that LLNL must rely upon the performance of others who may not be as dedicated to handling those wastes in the most environmentally safe manner.

1.1.4 A new DWTF must not be treated as an independent entity for the sole purpose of ensuring that LLNL operates in an environmentally acceptable manner. Generators of wastes must understand their responsibilities in aiding LLNL to meet all established policies and regulations on its discharges.

③

1.1.5 The DWTF should be capable of meeting presently established rules and regulations and of being readily modified to meet future rules and regulations that will undoubtedly become increasingly stringent.

4

1.1.6 All treatment and disposal steps should be examined carefully for their risk to the environment and those with the lowest potential risk should be chosen.

1.1.7 The DWTF can be developed to provide three levels of treatment. Those levels should be:

1.1.7.1 Level I Meeting of Presently Established Regulations

1.1.7.2 Level II Selective Reduction in Quantities of Wastes Sent Off-Site

1.1.7.3 Level III Maximum Reduction in Quantities of Wastes Sent Off-Site and in Forms That Have Lowest Environmental Risk

1.1.8 A Level I DWTF would include:

1.1.8.1 -- Upgrading of Present Incinerator

1.1.8.2 -- New Chemical Treatment System

1.1.8.3 -- Size Reduction Facility

1.1.8.4 -- New Decontamination Facility

1.1.8.5 -- Reverse Osmosis for Control of Dissolved Solids in Wastewaters.

1.1.8.6 -- Ultrafiltration Concentration of Oily Wastes

1.1.8.7 -- Solidification

1.1.8.8 -- Analytical and Control Laboratory

1.1.9 A Level II DWTF would include in addition to Level I:

1.1.9.1 -- Rotary-kiln Incinerator

1.1.9.2 -- Solvent Recovery

1.1.10 A Level III DWTF would include in addition to Levels I & II:

1.1.10.1 -- A Radwaste, Controlled Air Incinerator to

APPENDIX C

Estimated Comparative Costs for Waste Incineration Onsite at LLNL vs. INEL

It has been suggested that significant cost savings could result from offsite shipment of LLNL low level radioactive and/or chemically hazardous combustible wastes for processing at INEL. The objective of this assessment is to explore possible advantages and disadvantages of offsite incineration and to compare the estimated cost against that of onsite incineration at the proposed LLNL-DWTF.

Possible Disadvantages

1. Need for compliance with cumbersome regulations for interstate transport of radioactive and hazardous materials.
2. The INEL incinerator facility is designed and intended for incineration of low level radioactive wastes. The primary LLNL waste incineration requirement is for non-radioactive hazardous waste. There may be problems of compatibility.
3. If rail transportation is to be used, there may be a need for providing railhead facilities at LLNL. There is also a possibility the existing railhead facilities in the Livermore area (such as those at the LOX Equipment Co. site on Vasco Road) may be utilized provided appropriate permits and permissions can be obtained.
4. Possible opposition of state officials and public toward accepting waste from another state for disposal or any other purpose.

Possible Advantages

1. Significant cost savings (see economic analysis following).
2. INEL-WERF incinerator has ample capacity to treat LLNL combustible waste. Adding LLNL waste would increase the INEL facility cost effectiveness by economy of scale, i.e., by decreasing unit costs.
3. Avoiding "learning curve" problems. Operational "know-how" of INEL personnel would assure appropriate processing. Possible environmental problems from improper incinerator operation at the Livermore site would be precluded (i.e., BAAPCD would be out of the picture: one less regulatory agency to deal with).

Economic Analysis

To compare relative costs of onsite vs. offsite incineration, unit costs ($\$/m^3$) and annual costs ($\$/yr$) are estimated. Differences in required capital expenditure are also assessed. For purposes of estimation, the following assumptions are made:

- o Unit costs for processing LLNL combustible waste at INEL would be the same as for the unit cost for processing INEL waste ($\$137/m^3$; see attached Appendix C-1 which provides detailed itemization of INEL cost) escalated by an assumed 15% fee, or $\sim\$160/m^3$.
- o Disposal of incinerator ash from either the onsite or offsite options would be at NTS. Disposal costs for the ash are assumed to be the same in either case; therefore a "wash", and will not be considered.
- o Other than processing cost, the major expense to LLNL for offsite processing will be transportation cost. Three transportation options are considered. These are: (1) rail transportation with construction

of a railhead at the LLNL site, (2) rail transportation utilizing existing railhead facilities in the Livermore area, and (3) truck transportation (note: current regulations may preclude truck transportation, but, at this time, it is not clear whether this would be the case).

- o Packaging of combustible waste would comply with INEL procedures, i.e., all waste packaged in 2 ft square (8 ft³) corrugated cardboard boxes (shipment in these boxes is assumed with secondary containment provided as per DOT regulations).
- o Quantities of LLNL combustible waste are estimated from Table C-5 of the CDR and are:

Radwaste	38 m ³ /yr
Non Radwaste	548 m ³ /yr
Total	586 m ³ /yr

If the offsite incineration option is selected, it is assumed that certain combustible wastes (~ 150 m³/yr) will continue to be incinerated at the current LLNL onsite facility, or its equivalent. This would leave an estimated volume of 436 m³/yr of combustible waste for offsite shipment.

- o It is difficult to determine accurate capacity and unit shipping cost figures at this time. For purposes of analysis, the following estimates are assumed:

Railcar capacity 40 m³
Truck trailer capacity 20 m³
Cost per railcar shipment (LLNL to INEL) \$7K
Cost per truck shipment (LLNL to INEL) \$5K

Table C-1 presents a summary of estimated annual and unit costs for incineration of waste at the proposed DWTF at LLNL. Table C-2 presents a summary of estimated costs for shipment to and processing at INEL. These costs are sensitive to the transportation option selected. The comparative costs are summarized in Table C-3. From these data, it appears that a 50% or greater cost saving could be realized by offsite incineration if necessary arrangements to do so can be made.

For regulatory and/or other reasons, some or all of the transportation options may not prove to be feasible. This assessment is presented to provide a general estimate of potential cost savings assuming regulatory and other obstacles can be overcome.

Table C-1

Estimated Costs for Waste Incineration
at LLNL-DWTF Facility

Capital Cost

Construction of incineration plus ancillary
equipment and facilities - \$4,000K

Assuming 25 year operating period and
10% interest, annual cost for amortization \$460K

Operating Cost

Personnel (2 operators at \$100K/man year) \$200K

Ancillary costs (hazards control, QA,
administrative) \$ 50K

Total Annual Cost \$710K

Unit Cost

$710K/436 \text{ m}^3 = \$1628/\text{m}^3$

Table C-2

Estimated Costs for Incineration of
LLNL Combustible Waste at INEL

Capital Cost

Option 1	Rail shipment with railhead facilities constructed at LLNL site - \$1 million Estimated annualized cost	\$110K
Option 2	Rail shipment utilizing existing railhead facilities elsewhere in Livermore area. Estimated cost for access and improvements - \$200K Estimated annualized cost	\$ 25K
Option 3	Truck transport - no capital cost assumed	\$0

Operating Cost

Boxes and materials	\$ 6K
Labor for packaging & preparation	\$ 30K
Miscellaneous (H.C., Q.A., Admin.)	<u>\$ 20K</u>
Total Operating Cost	\$ 56K

Transportation Cost

Options 1 and 2 (Rail) (11 shipments/yr x 7 \$K/shipment)	\$ 77K
Option 3 (Truck) (22 shipments/yr x 5 \$K/shipment)	\$110K

Processing Cost at INEL

(436 m ³ /yr x 160 \$/m ³)	\$ 70K
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Cost Summary

	Total Annual Cost (\$K)	Unit Cgst (\$/m ³)
Option 1 (Rail + railhead at LLNL)	313	718
Option 2 (Rail + existing railhead)	228	522
Option 3 (Truck transport)	236	541

Table C-3

Comparative Costs of Onsite Incineration
at Proposed DWTF vs. Offsite Incineration at INEL*

	Onsite (DWTF) Incineration (\$K)	Offsite (INEL)*** Incineration (\$K)
Capital Cost ** (\$K)	4,000	0 - 1,000
Annualized Cost (\$K/yr)	710	228 - 313
Unit Cost (\$/m ³)	1,628	522 - 718

*Note: Costs for disposal of incinerator ashes, permits, and other regulatory expenses not included in the analysis.

**All costs are estimated.

***Total cost dependent on transportation option selected.

APPENDIX C-1

Combustible Waste Cost at INEL*

Operation of the radioactive waste incinerator at the WERF allows for the separation and management of combustible waste and realization of cost savings from the resultant volume reduction. Although the incinerator is currently operating on an experimental basis, the analysis will assume the incinerator to be fully functional and capable of processing 200,000 ft³/yr (5666 m³/yr). An effective volume reduction factor of 1/200 is also assumed. Capital cost for the incinerator facility is estimated to be \$3.5 million. The operating budget for the WERF is \$2.4 million annually and about 1/3 of this cost (\$800,000/yr) is assumed to be allocated toward incinerator operation. Accordingly, assuming a 10% interest rate and a 30 year operating period, the annual cost for amortizing the capital expenditure would be \$368,580. Therefore, the total annual operating expense (capital + operational cost) would be \$1.17 million, or \$206/m³ of waste incinerated. Because of the experimental nature of the facility, it is appropriate to ascribe a fraction of this cost (1/3 is assumed) to research and development. Therefore, the unit cost for operational incineration of LLW is accordingly assumed to be \$137/m³. It should be noted that operation of the incinerator at less than its 200,000 ft³/yr capacity would raise this estimated unit cost proportionately.

The ash produced in the incineration process is presently considered to be a "mixed waste" due to its high concentration of toxic stable materials. It must therefore be managed according to the Resource Conservation and Recovery Act (RCRA) guidelines as well as those for low-level radioactive waste. Current plans call for its solidification as concrete in 55 gallons drums and subsequent shallow land burial at the RWMC. Solidification costs are estimated at \$100/drum.

*Taken from Draft DOE/LLW-40T Rev 1 (July 1986) (Assessment performed by SAIC).

requirements) has been estimated to the \$20/ft³ of buried LLW (pers. comm. - R. Brown, KWMC). Projected closure costs of \$706/m³ must be added to the operational burial cost of \$636/m³ to arrive at a total burial cost of \$1342/m³. Table C-4 presents the total cost breakdown for combustible waste at the INEL.

Table C-4

Cost Breakdown for Combustible LLW Management at INEL

<u>Cost Item</u>	<u>Unit Cost (\$/m³)</u>
<u>Cardboard Box Containers</u>	
\$2/box x 4.4 boxes/m ³	8.8
<u>Labor</u>	
0.25 man-hr/box x 4.4 boxes/m ³ x 50 \$/man-hr	43.5
<u>Administration, Assay, Health Physics</u>	20
<u>Quality Assurance</u>	**
<u>Transportation</u>	
1.0 x \$/ft ³ x 35.3 ft ³ /m ³	35.0
<u>Incineration Cost</u>	137.0*
<u>Ash Solidification Cost</u>	
100 \$/drum x 5 drums/m ³ x 1/200 (vol. reduction factor)	2.5*
<u>Shallow Land Burial at RWMC</u>	
\$1342/m ³ x 1/200 (vol. reduction factor)	<u>6.7*</u>
TOTAL COST	\$253/m³

*See discussion in text.

**QA costs are dependent on the degree of quality control required.