DESIGN ANALYSIS

FINAL REPORT Topical

# DEVELOPMENT OF AN ON-LINE, REAL-TIME ALPHA RADIATION RADIATION MONITOR FOR LIQUID STREAMS

CONTRACT NO. DE-AC21-95MC32088 - 3

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## DISCLAIMER

This "Design Analysis" Final Report is the result of Task 1.3, Design Criteria and Specifications in the project titled "Development of an On-line, Real-time Alpha Radiation Monitor for Liquid Streams", Contract Number DE-AC21-95MC32088. It presents the overall requirements and needs obtained from numerous conversations and interviews with DOE Headquarters, DOE Operations Office, M&O Contractor, and commercial laboratory personnel.

Appendix 1 includes representative telephone transcripts that supported the design decisions summarized in this report. A consistent theme through these transcripts is that any new, reliable alpha measuring instrument that allows DOE to operate better, faster, and cheaper will get used across the DOE complex.

For reference purposes, Appendix 2 lists federal government regulations that can pertain to the monitoring of alpha-emitting radionuclides in water. These regulations provide a current framework for determining required minimum detection limits, data trending and analysis, and other features that would be required for any instrument measuring radionuclides in water. For instance, the maximum allowable concentration of natural uranium in any water stream is 30 pCi/liter, contained in 40CFR141, 142, the EPA's Proposed Rule for National Primary Drinking Water Regulations (the Safe Drinking Water Act (SDWA)). However, SDWA regulations also specify an adjusted gross alpha limit of 15 pCi/l; the proposed alpha measuring instrument would also need to be capable of monitoring at this lower activity level.

## Identification of principal criteria for the instrument design

### 1. Operating mode

The technology will allow for installation of the monitor so as to directly sample on-line, low level radioisotope-containing water from water streams, as opposed to the conventional technique of collecting and bottling samples for transport to an analytical laboratory.

### 2. Sensitivity

The monitor will be designed to analyze for alpha radiation to the drinking water limit of 15 pCi/l gross alpha emitters in the water stream, including a limit of 30 pCi/l natural uranium limit.

### 3. Response time

The present typical 2 week total end-to-end sample turnaround time will be reduced at least to a maximum of one day. Included will be the elimination of delays currently associated with

manual sampling, logging, transport, manual chemical processing and handling, and report reconciliation.

### 4. Isotopic analysis

Differentiation among radioisotopes will be provided by resolving the emitted alpha energies.

### 5. Archiving

A means will be provided to retain analyzed samples for future verification or additional analysis.

### 6. Automation

The monitor will be capable of operating unattended while making multiple sample analyses.

### 7. Minimize Secondary Waste

In routine operation the monitor will not increase the contaminant levels in the water undergoing analysis.

### 8. Instrument Environment

The alpha monitor will be designed for indoor use.

## Preliminary Specifications

| | |
|---|---|
| Detection limit | 30 pCi/l natural uranium, +/-50% |
| Sample turnaround time | 1 to 12 hours, with a settable high level alarm |
| Physical size | 24"w x 24"l x 48" h |
| Consumables | film supply, deionized water |
| Power requirement | 110 VAC, 15 A, 60 Hz, 1 phase |
| Operating temperature | 10° Celsius to 35° Celsius |
| Relative humidity | 20% to 90% non-condensing |

## APPENDIX 1

## TELEPHONE TRANSCRIPTS SUPPORTING DESIGN DECISIONS

**Transcript 1**

**Source:** **Fred Heaker - DOE Hazardous Waste Remedial Action Program (HAZRAP)**
**Telephone:** **1-615-435-3426**

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**General:**

He is an engineer experienced in environmental nuclear measurements. He was asked by DOE-EM-HQ to review the technical basis and merit for the Thermo Alpha Monitor (TAM), determine whether more development work should be done on the system, and whether there is a need for such an instrument. (The version of the TAM he studied was the initial jet-impingement-based Field Test Unit tested in Oak Ridge.) He reported to DOE-HQ that there is "no question" that a need exists for such a device, and that more work should be done developing the instrument.

**Details:**

Our energy resolution was "quite good", in terms of discriminating between radionuclides of similar energy; while our collection efficiency was "bad", in terms of the fraction of counts produced by radioactive decay in the sample that were measured by the instrument. The instrument could serve as a useful monitor. Fred retired before he could send Thermo Power a brief written summary of his review, although he did brief DOE-EM-HQ and DOE Oak Ridge Operations on his conclusions.

**Transcript 2**

**Source:** **Richard Sassoon - DOE Contractor/Original Report Writer**
**Telephone:** **1-301-924-6126**

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**General:**

He is primarily a numbers person. Sent Thermo Power a whole series of data on sample analyses on water. For example, number of sample analyses done quarterly for DOE across the US. Recommended that we speak with Joan Fisk at Los Alamos @ 1-505-667-0118. She is responsible for field measurements.

**Buyers and Sources of Funds:**

The actual recommender/buyer is the project manager or sample management offices in the field. To find source of influence you have to fund the appropriate organization within DOE and understand how it works (EM-50 for example). Thus the client or customer is either with the DOE or the contractor(depending on how one views this).

Put another way, EPA, various states, have regulations, but officially decisions on monitors will be made in the field. DOE only sends out general guidelines, but the field has to implement this.

**Isotopic Analyses versus Total Counts:**

*Based on the samples coming into the lab. the following numbers apply for 4Q'94:*

For gross alpha, beta only there were 9600 samples of water, 3200 of soil, 987 of sludge and 911 other. The numbers may vary a bit across the entire DOE complex. Multiply by 4 to get yearly demand baseline. Gamma analyses is a bit different. Add 2200 to the water figure per quarter for that. For field analyses start with similar numbers, with some differences in the numbers of analyses. For example, commercial may do a screening (presumably an additional test event) that field analyses may not do.

If isotopic analysis was done then 10,000-12,000 additional individual isotopic analyses were done on the water samples. The source for this would be either the 9600 samples talked about or additional (different) samples brought into the lab. For 1994, of the 41K total

samples, 55K inorganic analyses were done (1+ average analyses per sample). 41,880 rad analyses were done (1:1 correspondence). Mostly only alpha, beta gross screenings done. Specific isotopic analyses is done if there are suspicions. Gamma uses different instrumentation and is a different analyses.

Therefore in sum you have alpha, beta, gamma scans, plus any isotopic detection involved in the lab. Alpha, beta detection uses existing technology such as silicon diodes, gas proportional counters and liquid scintillation counters.

**Price Points:**

For gross alpha, beta the average lab. cost depends on the radiation level of the sample. $60-100 is the trend. For gamma scans, $100-200. These numbers are for commercial applications and include only analytical costs. The analytical costs in turn are a function of the type of analyses. Sampling, shipping, data validation costs are additional. For comparison purposes, field monitoring would be cost beneficial since even for one isotope you have to send to lab. at great expense, you save on transportation and other overhead costs.

**Need for low cost discrete sampling/continuous monitoring**

Also, you have to make sure that TAM provides the full sensitivity levels currently available (from lab. based testing). You will assume that regardless of the quality of results from the TAM, approximately 10% of the samples will be sent to the lab. anyway. That levels of testing done depends on the type of project.

Continuous versus discrete is based on specific need. There are lots of wells out there. The extent of monitoring will be driven by DOE regulation. . . If it is cheaper to do with continuous monitoring then (TAM) will be considered.

**TAM Units or Service/Portability:** Don't know/can't comment/ No opinions.

**TAM Competition:** Don't know/Not an instrument person/just a numbers guy.

**Alarm versus count accuracy:**

He does not have field experience, hence this would be his opinion only. The place to check would be statement of work (contracts) for different contractors at Fernald, Rocky Flats etc. to get a clearer indication on what would be acceptable.

Transcript 3

**Source:** **Dave McGuire - Oak Ridge MMES Y-12 Plant/Engineer**
**Telephone:** **1-615-574-0643**

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**General:**

Knowledgeable source for specific water sampling issues. In general, if Thermo Power product meets or beats EPA guidelines, and conforms to an EPA approved method, then there is a market for TAM product. He is a sanitary sewers compliance manager and is part of environmental management group. Based on his role, he does not see a role for TAM. Once there was a DOE requirement for TAM, now its no concern. (Editorial note: I believe this last statement stems from a transcription mistake!)

He does not have responsibility for process waste discharge (into streams etc.). He deals with some consumer waste, some photographic discharges, some garage waste when cleaning of vehicles. However, he can see requirement for process effluents that are suspected of groundwater contamination. When asked if there were regulatory requirements that required him to test the sanitary sewer water anyway (regardless of what they felt were sources, given that they were a nuclear facility), he seemed to indicate 'maybe'. They are driven by the 1954 atomic energy act that indicates that as a federal facility they cannot put anything in the water. DOE 5400.5 is also important which specify the derived concentration guidelines, which require that something needs to be done. However, all of this is not part of his job at the moment.

**Need for sampling/real-time feedback/continuous monitoring:**

Not important according to him. Turnaround now on radiation samples is 2 weeks, though most of the results are back in 1 work week. If a quick turnaround is needed, one can do it in a day. Cost per sample is approximately $100 per sample for analyses (not very sure of this number).

They do 1 sample per week now. Though some of the other 'jobs' (in the compliance area that is not part of his group now) require numerous samples per day at each facility. For them (not in his group), every batch sample will potentially need to be tested for uranium and other radioactive contaminants. With NPDES they can discharge to a creek. With no NPDES, they need to monitor alpha, beta and gamma limits; all isotopes may be a concern. Current frequency is 1 batch sample a day.

The other group (third) involved is the waste management department. They do their own process samples as they treat the water. Their current instrument used is a 'multi-channel analyzer'. Their exact frequency of use is not known or what their count times are. The TAM may be better suited here, compared to compliance sampling/testing. DOE may find this application useful.

**Discrete sampling versus continuous monitoring:**

No clear preference, as long as both comply with EPA regulations. For groundwater wells, contaminant plumes etc. continuous monitoring to show migration may be useful.

**TAM Unit purchase versus service:**

If EPA approves of the functionality, the procedures by which the samples are collected and the chain of custody issues analyzed (as they do for the current service), then the product is OK by him. The cost aspect of the current technology hinges on sample bottle preparation, preparation of samples, transportation, analyses, doing of data reports, . . . etc.

**Total count versus isotopic analyses:**

EPA dictates work here also. The difference in requirement is job specific. Total counts are a must, after which isotopic analyses can be done if needed. The current process/service does both.

**Integrated alpha, beta, gamma capability:**

Gross alpha alone would be good. Again this is job (application) specific, and EPA requirements will prevail. Alpha, beta and gamma in an integrated package would make the TAM more 'versatile'. The critical issue in radiation monitoring of plants is that alpha, beta and gamma are all needed '. . . to initiate further sampling '(presumably if there is contamination). Therefore, 3 action levels will be needed.

**Price issues/Buyers/DOE Influence/Sources of Funds:**

They (Oak Ridge) are always looking to cut costs. If TAM is cheaper then they will always look into it. *However, EPA technical criteria must be met as a starting point (regardless of price).* His input in this area is limited because he simply requests the sampling for his group. Someone else does the actual sampling and will be the actual decision makers for TAM.

Martin Marietta (MM) actually runs the DOE laboratory on-site for testing water and other samples. This lab. operates on a budget and is owned by MM. The lab. does not deal with many competitive products (presumably they have their own equipment for testing, including the aforementioned multi-channel analyzer). He referred Jim Eaton @615-574-1589 as the section head for the lab., who could talk on cost, competition etc.

**TAM-based testing of air, soil, oil:**

They (meaning MM) have an air group with air monitors. Air, in general, will be a good application. No particular comment or knowledge of oil. With soil, how does one make the samples ? How is the application made or structured ? Being a (sewer) water person, he has a very narrow focus.

**Transcript 4**

**Source:** **Jim Eaton - MM Lab. Section Head (Recommended by Dave McGuire)**
**Telephone:** **1-615-574-1589**

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**General:**

Dave McGuire mentioned that Jim Eaton may have answers on cost issues and had influence on buy decisions. Jim, au contraire, was very much on the defensive, turf conscious and rather uncooperative. Part of the uncertainty may be due to the sense that lab. employment will somehow be affected by TAM. He did not want to refer me to anyone else.

**Need for TAM:**

They already have a real-time MM monitor in place in their lab., that was built on-site? Therefore, why was TAM being done. . .? There is no real need for real-time monitoring at their locations, though a high-level hypothetical question has been identified to do comparative testing. They are driven by 'best management practices', which is closely identified with 'what does the public want?'.

**Cost:**

The average cost per sample is $100 at his lab. Uranium testing is not very expensive. For one sample a week this means $5200/year (their average now for compliance). It is the same cost per sample for many samples per day, if that is needed.

**Transcript 5**

**Source:** **Dick Scheper, FERMCO - Technology Source Integration**
**Telephone:** **1-513-648-6145**

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**General:**

He operates at a gross logistical level. Sent Thermo Power some water samples a few months ago and has been speaking with him for a year or so. He would like to know the status/progress of Thermo Power's effort. He is still interested in a water, field test-unit. He appeared to be a very friendly source. My recommendation would be to use him a beta source to help thoroughly field-test the functionality. He also appeared to be a little hesitant to mention/discuss competition. At a minimum, Thermo Power should initiate a technical conversation with him about the feasibility of and parameters for a technical beta test site for TAM.

**Radiation Water Sources:**

Mainly Process Water and Ground Water. Uranium contaminated plume exhaust through pumping heat regeneration system. Individual well-heads or common collection stations. Prior to and after water treatment. Monitoring useful for ascertaining levels and also efficacy of clean-up. This is a screening tool to divert clean water away from clean-up location or dirty water to clean-up location.

**Need for low-cost discrete sampling:**

EPA will require on-site counting. 20 ppb acceptable level for his site. Right now they do Oxygen, PH values etc. (ion-exchange resins, filtration etc.) so why not do uranium also (locally). Check prior to going into the process plant and divert. For well-head and groundwater discrete is OK.

**Real-Time and Continuous Monitoring:**

Real-Time more accurate; reading once every 3-4 hours. Need monitoring and continuous documentation of what is happening versus physical sampling (each time). With ground water physical sampling is OK - given its slow movement, the ultimate decision of what to do will not be affected. However, effluent is more critical to the system - more real-time answers are needed. That is, (actionable results) are needed more than once a day. Actually, continuous

sampling once every 30 minutes to 1 hour would be good. 'Strip' data not needed, only 'point' data.

**Customer Preference Buy Units versus Service:**

This is a very tough question. DOE is interested in privatization (euphemism for efficient ?) and cutting costs. Personally he would prefer to purchase unit/s for his site. One reason being that they can use in-house staff to do the associated work.

**Price Points/TAM Units or Service:**

The price gas to be competitive with current costs of sampling. Baseline process *now* is that crew goes out to well-head, takes a sample, transports to their lab where the analyses is done. The preferred frequency is 4-5 times a day, though now they are only taking 1 sample for 2-3 locations. When the remediation operation gets going and they are pumping full-scale, then the total sampling may reach up to 6 times per site (12-18 per day form all locations) for accurate measurements. Each division has a manager of lab. services

Currently however, they are in a planning phase (in a sense anything that Thermo Power may have to offer to the mix may be helpful) and not fully operational. The plan is to have a certain number of people and equipment, but the cost aspects have not been fully fleshed out. However, the fact that "instrumentation is needed" has been planned for. Pricing is an open question. No clear sense on investment source, beyond the fact that it budget dollars.

**Buyers:**

From a marketing perspective, (Thermo Power) should recommend the instrument to five different operating units. His group is the ground water recommender and a primary DOE contractor. His group will specify the instrument needed (hinting therefore that Thermo Power should work with him). Given that Thermo Power is a sole source for the technology, DOE will have to follow his group's recommendation. DOD, EPA and private industry are others.

**DOE Influence on Buyer Segments:**

From a recommendation perspective, each group (in his environment) proposes a remediation plan involving time, people, overheads, maintenance, and acquisition costs. DOE approves the whole thing as a package. The problem is DOE demand projection (with any degree of confidence). Lots of uncertainty if it will be around this time next year . . . and so on have to be factored in.

You have to understand that DOE is (and will be) paying for Thermo Power's instrument. It will like to transfer the technology and take credit for creating . . . the instrument (and presumably the overall demand for it). EPA faces the same issue (in 'privatizing' technologies). Therefore, DOE will look favorably at any proposal (coming directly from Thermo Power on applications and usage).

**TAM Competition:**

His understanding is that Thermo Power is DOE sole source on project and therefore he cannot think of any direct competition. Canberra, TMA Eberline, SEG appear to be moving very rapidly in this area. The underlying technologies are active, preempt? gamma neutron detectors or passive silicon, germanium detectors.

**Specs. for Continuous Monitor:**

Monitor plot or strip chart like a seismograph would be helpful. This could be embodied in a presentation or digital readout. An alarm would be useful to indicate that a certain effluent criteria is not being met. Then the readout would enable a decision whether to divert to a continuous circle flow, maintain a holding pattern or shut the flow down. Overall the system must not be labor intensive. The above discussed features will enable checks and balances and would be helpful prior to dumping clear water in streams.

**Portability:**

For the field portability is useful (i.e., suit-cased sized operation). To extend this aspect, it would be nice to have a unit "permanently" fixed to each well. For example, with a T from the flow line. (This capability presumably will enable other advantages and efficiencies). From a design perspective, the instrument will be covered in a box. "Weatherized" for sub-zero temperatures assuming nation-wide usage. Also, the instrument must be able to operate at 100 % relative humidity and 150 degrees in the box.

**Isotopic Analyses versus Total Count:**

Isotopic analysis at the process end is not very important. Total uranium will be sufficient for characterization of the site. For remediation purposes, any feasibility studies will need full-scale analyses . . . very important.

**Integrated alpha, beta, gamma:**

This is not important at his site. However, the DOE or other users (remediators/clean-up folks) may need this. For example plutonium may need integrated capability.

**Potential for testing air, soil, oil:**

Scheper is primarily a water/fluid-stream instruments person. Soil, air, oil may not be as useful for him.

**Transcript 6**

**Source:** **Al Tardiff - DOE HQ CMST**
**Telephone:** **1-301-903-7360**

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**General:**

Did not think Thermo Power was serious unless all alpha emitters covered. Did not want to discuss it until Thermo Power had sent him all the various regulatory limits on radioactivity levels. Wanted Thermo Power to fax him the data (followed up on 05/16/95).

**Radiation Water Sources:**

Treatment systems effluent streams and waste disposal facilities have to be monitored for alpha limits. Any and all radionuclides that emit alpha. Need to stay with EPA guidelines on alpha emitters, by source. Product must be able to function in all ranges.

**Air/Soil/Oil:** Russ Gritzo @ 505-667-0481 has been working on air testing.

**Low-Cost Discrete Sampling:** No specific response to this question. TBD

**Continuous monitoring:** Good question. Would be preferable, if the dollars allow it.

**Pricing:** Baseline pricing/cost for current methods, speak to Steve Booth (Atlanta).

**Units versus service:** TBD

**Buyers and Source Of Funds:** TBD

**TAM Competition:** TBD

**Portability:** Will be an application (of the baseline technology). Useful with a mobile treatment system. May need this (as an alternative to) transport of liquid effluent.

**Alarm versus count accuracy:**

Alarm will help in divert and control situations (real-time). Greater ease of use (is important here).

**Isotopic analyses versus gross count/integrated alpha, beta, gamma:**

Yes, full functionality will be advantageous.

**Transcript 7**

**Source:** **Chris Scott - Manager, Process Waste Treatment Plant, Oak Ridge, MMES-ORNL**
**Telephone:** **615-574-7057**

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**General:**

Seemed a little wary. They have some experience with on-line monitors. There are some lessons here for Thermo Power in finding out what the product flaws were. He would like 'his guys' to look at (Thermo Power's) instrument - 'buy it, start-it up and run with it'. Typically he feels that this type of equipment will not be simple. His concern is that its complexity may make it difficult 'to get someone' to maintain it. Training (by Thermo Power) was also seen as an important issue. He requested that Thermo Power give him an update on how this product can be used with respect to waste streams.

**TAM Application:**

*Process Waste Treatment:* The product would be useful in monitoring several waste streams, reactors and process waste treatment facilities. Alpha is present in overheads during evaporator volume reduction for example.

*Lab. Analyses:* They had an on-line instrument before that did not work; alphas were easily shielded in water, maintenance was a problem. The instrument was very delicate and easily broken (it has some film technology, which apparently was very fragile and broke when cleaning, for example).

**Discrete versus continuous:**

Continuous preferred; real-time results very important. The results will be telemetered back from the field to the wastes operations control center. Currently with their discrete service there is a 4 hour turnaround time.

**Service versus Unit Purchase:**

They would prefer to purchase.

**Price of Units/Service:**

Cannot comment at this stage.

**Buyers and their Sources of Funds:**

His group would order it. They would recommend it to their purchasing agent. Typically, it gets put out to bid. However, given that (Thermo Power) is the only ones who make this product, it would be 'sole source'. DOE/EPA influence in actual purchase decision is small.

**TAM Competition**

No credible competition is present (if Thermo Power) product can do as it claims.

**Continuous Monitor Specs./Alpha, Beta, Gamma Integrated Capability**

Accurate alpha monitoring accuracy is needed. Beta and gamma would have been good also, however, they have (relatively recently) replaced their beta and gamma test equipment. In the next year or so, this additional feature would be 'repetitive'.

**Testing air, soil, oil**

This will be useful, with accuracy in readings a (very important criteria) - especially screening on oil.

**Transcript 8**

**Source:** **Rich Nevarel - Program Manager, DOE Waste Management, Los Alamos**
**Telephone:** **1-505-845-5804**

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General: He sounded like a senior DOE manager, and is intimately involved with the budgeting process. He came to his current job around five years ago, after a stint at Richland, Washington. Any sales pitch, whose scope is beyond the $200K limit, involves a capital decision. His office then gets involved. Contractors have discretion under this limit. I limited our discussion to non-technical issues. He mentioned that he did not know Thermo Power and was interested whether our product was now available for deployment/sale.

On technical issues, he recommended that I speak with (and keep in the loop) Tony Stanford, Facility Manager of Low-Level Waste at 1-505-665-8681. Also, he mentioned a relative newcomer Michelline Devaurs @ 1-505-667-1519 who would be interested in alpha monitoring instrumentation. She is an ex-PM, who is looking into what he termed as 'restoration' activities. He also mentioned that Rudy Guercia, at Westinghouse, Hanford Complex in Richland, Washington would also be interested in an alpha monitoring equipment. His number is 1-505-376-5494.

(My suggestion is that these folks be contacted as soon as possible, there appears to be a market need for this within Rich's regional domain of influence).

**Buying Influence/Decisions:**

He overviews the budget for waste management processes. They make sure that the technical scope is fulfilled, along with compliance monitoring. A limited amount of technical assistance is provided by his office (the sense being there are other groups - see phone numbers above - that are better placed to provide technical help). They have seldom looked at monitoring however, that being the purview of OSHA types . . .

Buying of any type of equipment or service is in the 'contractor's decision'. Cumulatively for any one procurement, if the dollar value exceeds $200K then his office gets involved. He concurred that this was the divide between the contractor's operating budget and DOE's capital budget requirements.

Budgets are set for 1995. October is when they will be setting the budgets for 1996. He was interested in knowing whether Thermo Power's TAM was a robust product at this point (i.e.,

is Thermo Power is ready to start selling this product). Part of his enthusiasm may be due to my description of what the TAM was all about, potential cost savings, DOE tech. transfer mandate etc. He may have sensed that the technology was unique, conviction bolstered by the fact that DOE CMST was the original underwriter. I mentioned that we had done a prototypical demo some months ago, and that we were perhaps a few months away from a beta stage. But that we were looking for partners, who would buy the product from us. Wanting the price range, I ventured around $ 30K figure as a ball park but that we did not have all the facts in. He suggested that we talk to Tony who may be able to help Thermo Power from a functionality standpoint.

A robust product in his opinion will find 'many users' in his DOE geography. He mentioned Michelline as another good contact, perhaps for a different application market ('restoration' ?).

Now for one unit in the $30K range, in his opinion, there should be no problem for the contractor to purchase this (assuming that the unit functions as advertised). The $200K threshold is reached in two ways - either one contractor - say, Los Alamos - buys multiple units or various sites in his 'region' take one or more units.

If other 'contiguous' (logically/physically) sites such as Albuquerque, Kansas City, Los Alamos, Sandia etc. etc. (with their different application demands for alpha monitoring) ask for this product, then he can turn over the request the contracts procurement division (different from his waste management division). This division presumably arbitrates budgets, purchasing etc. across the DOE complex, by region perhaps (I am not clear on span of control yet). The bottom line being other than his region, there is one other region (Chicago) that has multiple divisions under it. The procurement for all of the US can effectively be centrally driven form two or more such regional jurisdictions. Other than Los Alamos and Chicago, Colorado may be another region.

There are 30 sites there were in all, across all regions. Of these, about 10 may have potential for TAM, but there are 4 highest potential sites for TAM/Waste Management - Savannah River, Idaho, Oak Ridge and Hanford (The suggestion being concentrate initial selling to contractors here as they may have new funds and/or mandates for alpha monitoring).

Rudy Guercia may be another good source in Richland, Washington. He needs an alpha monitor and is part of the Westinghouse Hanford contractor.

**Transcript 9**

**Source:** **Mike McDougall - Manager, Thermo Analytical, Oak Ridge**
**Telephone:** **1-615-481-0683**

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**General:**

He has primarily bought instrumentation from Canberra Nuclear. Being a sister company, he is very interested in Thermo Power's success. Oak Ridge has 2 radiochemistry labs., 3 or 4 other organics labs and a couple of other inorganic labs.

The key application according to him is the need for environmental restoration. For example in city (water) lines, sanitary sewers. Environmental monitoring (CERCLA) of effluent plumes is an on-going operation at DOE. Nuclear facilities and other (phosphate) plants with naturally occurring radionuclides are another application source. Or radionuclides being present in geo drilling operations. The bottom line according to him is that there are lots of applications, limited only by the imagination. Thermo Power in his opinion, must hard sell costs savings to people (through the use of its product . . .).

**Laboratory Process/Cost:**

Depends on the site, where the sample comes from. You could have transuranics, natural or enriched uranium in the sample. Lab. cost to vary from $50 per sample to $1500 per sample. Norm is $50-200. The low end might be if one was testing alpha, beta only for a city (drinking water). The probability that the TAM will be used for $1500 per sample type of tests is 1:100.

Other costs include sample collection, shipping, sample disposal etc. that are equal or greater than analytical costs. At Oak Ridge, MM contracts both with on-site and remote labs. across the country, though these later lab. costs can be very expensive. (For some strange reason), the criteria for selecting a particular lab. at any given time is "lowest analytical costs" (and not total end-to-end costs) - *the contractor does not really care.* The contractor's money is mad if they can line up '5 to 6 people' (headcount motive ?) to do the sampling on-site. MM gets their money this way at Oak Ridge. (Again for some reason), the contractor does not get any benefits (taxpayer dollars) for the sample analyses. It simply chooses the lab. that charges the least. Labs. typically compete through bids - being competitive there is a natural inclination to keep costs down.

The other adder to lab. costs is paperwork. He does the 95% exhaustive paperwork trail (seemed as though computer office automation would be able to help here to cut costs, if integrated somehow into the lab. process) - only then he sees a sample. The costs are out of line with the work done because he sees numerous samples.

**Buyers/Influences:**

For the Thermo Power TAM, it would be best to sell to the contractor directly - DOE is simply in the technology transfer business. Some contractor names - MM, Dames and Moore, Jacob Engineering., MK Ferguson, Ebasco?, EG&G etc. are major players. Given that they are indifferent to lab. costs may be a problem. However, Thermo Power sales pitch should be based on their source of contaminants (technical handling of all source contaminant), plus cost savings to get them interested.

His lab. can buy the alpha monitor. Thermo Power can talk to his clients. Technically, his clients must insure that water sources in their sites stay within certain EPA guidelines. Thermo Power must familiarize itself with standard protocols based on EPA guidelines. Purchase decision is 1) a technical decision (can Thermo Power TAM get the job done) and 2) does the product have EPA certification - the certification cycle takes up to a year before a new method (say Thermo Power TAM) gets recognized (certified).

Regulatory bodies EPA and DOE are separate and both need to me conformed to. CERCLA's primary responsibility for clearing up EPA listed facilities.

**Discrete vs. continuous:**

Discrete has the low cost advantage; problem is that between discrete batch samples, does the site (for example, drinking water) conform to the safe drinking water act. Before, he can put a firm price, he needs more information. He wanted Thermo Power to talk to him, send information to update his knowledge of the technology.

**Competition:**

Apparently a company ORDELA has a $20K liquid alpha, liquid scintillation model in Oak Ridge. They apparently have sold $2M worth in a few years. Canberra Nuclear, EG&G/Ortec, Oxford (Tennelec) are other field monitoring competition. Cost apparently is higher than Thermo Power TAM.

Also for about $500K they have ionization mass spectrometers for thermo-ionization real-time monitoring. This has a calibration for a few hundred ppb. Also Oak ridge has ATOM

SCIENCES' ionization resource spectroscopy (laser mass spectroscopy) field units of which several were sold in total. Some DOE Technology Transfer is involved with this (the resolution appears to be at the level of an atom). Disadvantage: Price is $1M range.

**Alarm versus count accuracy:**

Depends on the source of contamination. Count accuracy would be typically needed with waste water. 95% confidence level needed for conventional analyses - i.e., replicate analyses. On being asked percentages, he said that about 10% of the applications require alarm only; 90% would require accurate counts. Most people (lab. folks presumably) are concerned about the need for accuracy. (The point may be moot for real-time monitoring). Alarm only can't be done legally for real-time because of the need to 'quantify' everything and everywhere legally.

**Number of Samples:**

Done weekly, monthly, quarterly, annually based on source material. However, if applied to nuclear power plants' coolant water discharge, then the frequency may be every hour, every day. Thermo Power should base (the frequency) on EM plan on environmental impact study from the regulatory agency (presumably having jurisdiction). This EM study is updated regularly (and therefore Thermo Power should stay on top of it).

His lab sees samples from all over the US. The sample mix roughly = Oak Ridge 20%, Savannah river 40% and all other 50%. He mentioned FUSRAP - something perhaps that Thermo Power should be aware of - this is a environmental restoration program in 50 sites.

**Isotopic Analyses versus Gross Counts:**

For municipal water samples gross counts are OK. Else, make sure for various other types of sites that you know what the regulations are (typically isotopic analyses needed, but what exactly this means varies by site). He mentioned that Thermo Power should target municipal water supplies and put an alarm in every water facility.

**Need for integrated alpha, beta and gamma:**

*For municipal water supplies,* that is safe drinking water. A simple GPC (Gas Proportional Counter) is used to count alpha and beta, for an average $50 charge. For perhaps a slightly higher cost beta and gamma are counted. (Beta presumably is measured alone) Alpha and Gamma counts thus obtained, by subtracting out beta. You cannot exceed the $50 threshold in the municipal sector.

**Oil, Air, Soil and other contaminants**

In a typical year his lab. sees these and many more types of contaminated material. In broad terms however, he sees close to 50% water and 50% soil in his lab. Water in his opinion is more difficult, one reason for which is that the volume of water needed is greater. For soil a mixed acidic solution is needed for dissolution. This process for soil is easier to do, with reagents, but more expensive. However, he sees a higher 'success rate' with soil and fewer re-runs (repeat testing).

With Thermo Power's TAM (based on what he knows from the demos 9 months ago) there is a real need to re-analyze a sample. QA and QC lab. requirements have to be met (for example, there is a lb. analyses sample, a blank reagent and one other sample that needs to be analyzed (and presumably, consistent results obtained thereof).

Additional thoughts on making TAM technically viable for his market:

- Thermo Power needs a lab. analyzer QC from some (third-party) lab - presumably to verify results and TAM's applicability.
- Thermo Power must participate in 3 radionuclide intercompany programs (DOE)
    - Mixed Analate Performance Evaluation Program (MAPEP), INEL
    - EMCL, Las Vegas (water)
    - EML, Manhattan

This types of certification is why it will take up to one year (presumably to make the product DOE certified and compliant). However, you do not have this time-frame hurdle with municipal water and therefore Thermo Power could start here (that is initial market in parallel could be municipal safe drinking water). One thing to bear in mind is that DOE is cutting costs and that his lab. workload are down about 50% from a normal basis even though his lab. is still backed up).

**Other Buying Issues:**

The purchase of TAM will be a separate line item in some cases (seemed like a euphemism for capital budget) and 'buried with other activities' (operating budget ?). But Thermo Power needs to know what they (meaning labs.) are currently paying. (presumably to be able to differentiate on price). Also, Thermo Power product must be 'good as you say it is' (meaning, if you are claiming technical spec or performance differentiation, then you must be able to back it up with proof or demonstration).

**Specs. on continuous monitor:**

They use field labs. Data has to be accepted currently in a discrete sample analyses mode. Field contractors however, would prefer continuous. Integrate the results in a Personal Computer or some readout wherein the actual activity is shown.

**Transcript 10**

**Source:** **Paul Wang - Manager, DOE CMST Program at Ames Lab**
**Telephone:** **1-515-294-6773**

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**General:**

He is purportedly an expert in many instruments. He is familiar (to a limited extent) with Thermo Power's TAM as used for waste effluent monitoring. He suggested that I speak with 'users', since he is more on the technology side of things. He 'remembered' Thermo Power TAM deployed in one of the creeks at Oak Ridge. CMST is in the technology development arena: users call them (his group for example) for technical recommendations, developers such as Thermo Power get information from his group on EM needs and requirements. He referred me to Keith Kibbee (formerly a D & D coordinator for large scale demonstrations at Oak Ridge). Ph.: 615-220-4035. Fax: 616-241-7964. Doug Hoffman is another good contact (he did not have his number) at Oak Ridge.

**Thermo Power's TAM Product:**

He was the original reviewer of the TAM two years ago, though he does not consider himself an expert in alpha monitors. Since Phase 1 he has not kept up with developments (presumably, he should have been kept in the loop). His sense was that not too many products can do what Thermo Power's product can do. He mentioned that whenever his group gets a call from a user on alpha monitoring, they either refer to Thermo Power or to another company located in Massachusetts (or perhaps Oak Ridge) whose name he cannot recollect. Presumably, this other firm is a competitor of Thermo Power. He said he was happy to share his opinions on the field.

**Discrete Versus Continuous:**

He is not too sure, since he is more on the technology procurement side of things and is not the site manager. He mentioned that a few sites were interested in ground water (for example, Savannah River).

**Integrated alpha, beta and gamma:**

To his knowledge only the Brookhaven National Laboratory had an integrated detector. This incorporated a Diamond coating (for alpha) on zinc telluride (beta and gamma). Using

spectroscopic principles, however, there are various (other) packages that do alpha, high-end beta and beta + gamma. However, the basic idea (strategy/approach) is (should be) to analyze all (three) at the same time.

**Air, Soil and Oil:**

There is some interest (at DOE). For example, reactor facility decontaminating, decommissioning and dismantling issue, cut it into pieces to handle it. There is need to know where the hot spots are - for example, concrete floors. DOE Demand will be very high in his opinion. This will not be in the remediation side of environmental soil, but in D&D program. There are program documents that detail the buildings and facilities slated for D&D. Presumably, Thermo Power should be able to access these records.

**TAM Demand in D&D:**

DOE apparently has five focus areas, of which D&D is one of them (March/April 1994 is when the related preliminary documents were first published). The five focus areas have related infrastructure issues that are still being established. DOE is still visiting sites and verifying requirements. All 5 focus areas are in the collection, verification, validating stages. The earliest set of final documents is expected out in July/August
1995.

**TAM Demand in Plume Migration:**

His suggestion is that other than D&D, Thermo Power could take a look at the Plume Migration Focus Area. This deals with solid and groundwater contamination.

**Portability:**

In D&D one has a need for portability. There will be the (potential) need to move equipment to different buildings and individual floors made of concrete. The application involves washing and wash effluents. These effluents will not be collected in a central place - but rather in separate, distinct locations (decentralized storage bins/vessels, perhaps). The upshot being maneuverability is important.

**Continuous versus discrete sampling:**

This is an operations issue and hard to answer.

**Isotopic Analysis versus total count:**

This is hard to answer. Even if one knows the isotopic content of 70 - 80% of surface contaminants (and this is typical), there is still a good 20 - 30% (whose isotope content presumably differs by sample/site). Then 20 - 30% will still have to be identified. (Hence the Thermo Power TAM product could be a two stage tool). Total counts may be a first stage "screening" tool (presumably to classify the source - the 70 - 80% of samples for which low activity counts are typical). Speciation can then be carried out for the 20 - 30%. The caveat is that his opinion is biased ". . . given that he is from a developmental point of view." Thermo Power must talk to operations managers for specific queries.

Transcript 11

**Source:** **Russ Gritzo - Los Alamos, Air Expert**
**Telephone:** **1-505-667-0481**

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**General:**

This expert was recommended by Al Tardiff. He is affiliated with the Univ. of California on DOE funding, and is an expert on radionuclides in air. His feeling is that air and water necessitate fundamentally different approaches from an implementation point of view, though they may have similarities in the R&D and design development stages. His organization has developed a large area scintillation chamber, which is expected to be field tested in July. (The impression I got was that they may have a long way to go before their product could be certified and viable).

**His product:**

95% of their efforts are in the area of air, and it appears that they (like Thermo Power) may have obtained exclusive DOE funding. For air, the product is strictly an alpha monitor and his sense is that the product can be adapted for alpha, beta, gamma (once the limits are determined for which this reengineered product can be useful to some organization). The product now is fast, real-time and 'alarming'. According to him, 2 elements are key to alpha monitors - response time and detection limits. No known (regulatory or other) guidelines exist as far as he can see for detection limits on continuous alpha monitoring. The technology does not exist. Their product cannot do continuous measurements for a long period of time. But it is able to do fast, real-time measurements (0 to a few seconds response) at the pico-curie/liter level. Air and water sources use different structures for scintillation chambers. Scintillation is different from ionization.

**Their business:**

He suggested that Los Alamos develops the technology, debugs it and licenses it to commercial parties. There is potential for example for a MOU (Memorandum of Understanding) with private parties (like Thermo Power). EG&G Nuclear Instruments for example is one party that licenses the technology. With a July deadline, their team apparently is going full bore on the development of the alpha air monitor.

**Market potential:**

Demand for an air monitor in his opinion will be realistically small. Large area waste treatment offers in his opinion, a major market. Apparently his product also detects radon very well, and this application is currently under technical development. He is interested in exchanging technical information. He would like to know what Thermo Power's products are etc. He is faxing over a brief on his air monitor and its underlying technology. His address: Russ Gritzo, J514 - PO Box 1663, Los Alamos, NM 87545, Fax No. 1-505-665-4955

**Transcript 12**

**Source:** **Keith Kibbee - Battelle Labs. Oak Ridge**
**Telephone:** **1-615-220-4035**

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**General:**

He is not directly familiar with Thermo Power TAM. He has read about it. He is primarily a business development person for Battelle now.

**TAM Competition:**

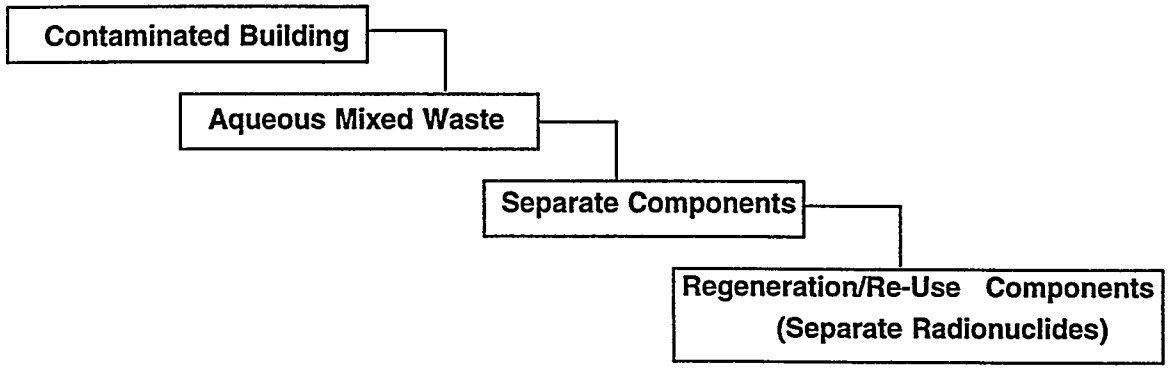
Apparently ORNL has a similar technology.

**D & D opportunity:**

They (Battelle) were sent recently to talk to folks at Hanford. The project potentially was a 'stabilizing project' of a end-reactor (EM-40 funded). One building had plutonium 5 scattered all over it. They were looking for unique ways to detect this in cracks, etc.

He was interested in if Thermo Power could measure uranium in concrete. Water may not be used (or permissible) in certain applications.

He mentioned that we should speak with Teresa Fryberger (a counterpart to Caroline Purdy) at ESP (Efficient Separators Program). One potential ESP application is shown in diagram below, which refers to a component separation application.



Thermo Power TAM can be used at final output stage (regeneration/re-use), since ESP is not looking at this part. However the cost is not known at this stage. A caveat: DOE may be moving toward axing all D&D funding - a programmatic reality in the quest for dollars.

**Waste Water Applications:**

Laboratory Managers are best equipped to deal with samples. They are usually "behind" and 'stacked up". (Presumably) Thermo Power TAM will help increase the throughout of their work. Internationally BNFL (Great Britain) Richmond, England may need something like Thermo Power TAM. BNFL has some US offices for sales purposes and Thermo Power can do some 'reverse salesmanship'. BNFL has private-side, light water reactor systems. They have to monitor coolant; They have a problem with activated corrosion; Water chemistry has to be controlled on-line and off-line. They deal with dilute acids. They also have to remove aspects (of radioactivity, if any).

**What else can Thermo Power do ?**

He mentioned the Morgantown Energy Technology Program (METP) and Steve Bossart as the contact. Steve's phone number is 1-304-285-4643. Steve should be contacted by Thermo Power about a demonstration. METP also has a July conference. Thermo Power should plan to attend this conference to look for opportunities. At a minimum Thermo Power should get on Steve's mailing list.

Even if D&D goes away, ESP will stay and may be the one to target. ($2B cut in 1996 in Grumbly's budget may result in wholesale stoppage in D&D). Unlike Paul Wang, Keith was not bullish about D&D. However ESP (remediation, ground water, waste water etc.) will be a useful market for Thermo Power TAM.

**Other:**

Keith's address: Fax No. 1-615-482-7964. Battelle Labs, 151 Lafayette Drive, Suite 110, Oak Ridge, TN 37830. Keith also wanted to get Thermo Power literature, if any. The other ESP contact is Jack Watson (who works for MM). Ph.: 1-615-574-6795. He is a chemical engineer/very knowledgeable. Thermo Power should explain technology to him.

**Transcript 13**

**Source:** **Kathleen Hain - INEL**
**Telephone:** **1-208-526-4392**

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**General:**

3 years ago she was the DOE manager evaluating the Thermo Power bid. She has no opinion on how Thermo Power TAM works, since she has not seen it yet. Her recollection is that the product detects alpha-emitting radionuclides and was tested using liquid environmental streams at Oak Ridge. According to her there is still a need now in the clean - up market. The decision points on TAM usage/purchase are the responsibility of separate contractors at each site.

Thermo Power should keep JIM OWENDORF, an ex-Air Force person in technical development, in the loop. Thermo Power must show him the product - but he himself cannot influence all the contractors across the DOE. Thermo Power should also certify the product with the 'Western Governors' - presumably all states where a need can be identified. Now the environmental requirement will expand to other states but specifically CA, MA, NJ, NY share demo data if any one of them (i.e. the appropriate state regulatory agency) approves of the demo. Typically, in her opinion, states needing (something like the Thermo Power TAM) are Princeton Plasma in NJ, ETEC (a private site in CA), the Susanah site (?) in CA and the University of Chicago & Argonne National Laboratory in IL.

**What is clean-up ?**

This involves (i) compliance (regulatory) and (ii) D&D. Within the scope of D&D, there have been 3 deaths within unsound buildings (structurally). The challenge technically is to recycle contaminants. Separate funding is involved for this activity. Tom Grumbley apparently has four points in his D&D program:

(a) The program attempts to reduce mortgage and risk. D&D activity is beneficial to this.
(b) The program involves restoration.
(c) Alpha monitors are useful for studies and for daily monitoring of hot spots. Thermo Power TAM will be useful when detecting contaminants (for effluents) obtained from washing hot spots.
(c) Sensor may have more uses than immediately available - for example in studies, on-going monitoring, past clean-up and tracking of waste.

**Idaho (INEL):**

RODS (Records of Decision) have already been done in 1995. This specifies the clean up through 2010 and D&D through 2050. The market in this segment is, therefore, spread-out over time. Now as DOE waste management budgets come down, more and more waste will be held in compliant storage, but not cleaned-up. However, monitoring will be very important and budget will remain strong. Revenue potential will be in product initial price plus maintenance. Buyers will look for price & performance.

**Plutonium:**

Some overall use exists in weapons plutonium or fuel for commercial reactors or in overseas markets such as the Soviet Union.

**Privatization on Hanford Tanks:**

These are major alpha emitters. 3 teams are involved. The idea is to take low-level fractions to high - level waste. Liquid effluent is converted to vitrified glass. Talk to Parsons and Greenman. The potential for Thermo Power is in monitoring, once the site is built. 1995-96 is the design aspect (presumably this is a long term project, with Thermo Power revenue prospects in the 2-5 year period). Thermo Power should partner, given that there will be big teams involved. To start, Thermo Power should sell 1 test unit to (potential) partners.

**GTS Duratech, Columbus, MD:**

This has immediate potential (Thermo Power should get involved). The application is vitrification system of wet waste at Savannah River (Emory Basin). Depleted uranium, low level cesium and strontium are involved. Catholic University - for one - is working on design issues. An attempt was made to take a mobile meter to Rocky Flats to do off-gas control (monitoring of "hot" scrubber solution volatilized alpha emitters).

Talk to Bill Greenman 410-312-5122. Caroline Purdy is the technical expert on Thermo Power type alpha monitoring.

**Municipal Market:**

The fear factor is not that high, (given that) transuranics don't migrate.

**American Indian Reservations:**

San Il De Fuso in Pueblo, NM (near Los Alamos) is a prime example. They are concerned about the plutonium that is handled at Los Alamos. This is an independent Indian Nation that borders this site (Los Alamos). They are very independent and want to own their own capability (to monitor municipal waters and presumably they have independent purchasing capability also). The sale of TAM units will be (politically) feasible also because the tribe is looking to develop jobs internally (the service aspects associated with monitoring radioactive material, for example, may be a carrot). They don't trust Los Alamos. Thermo Power should market/sell the fact that " . . . their own people can be the technicians . . ."(once the units are installed).

**Overseas:**

The key point person is Gary Vest - who is chartered with clean-up of all NATO sites (Owendorf used to work for him). He is a deputy assistant secretary in DoD. The clean-up of all Soviet sites & Baltic states (Estonia, Latvia, Lithuania) are key targets. Discussing Germany (East) relative unemployment & in -bred technology (many make it a hard sell for Thermo Power). In most overseas markets, selling units should be the approach ". . . so that locals can have service jobs". In this way " . . . they (overseas customers have something to offer and you (Thermo Power) have something to offer . . .".

**On Quantitative Market Numbers:**

- On potential number of labs, Mike Carter's group is the best source for commenting on the analytical validity of sampling (within DOE, 1-202-586-5000).
- Contact Owendorf of for schedule on site cleanups.
- Private publications/Industry Trade Associations.

Or magazines (Environment Today ?) are probably better factual sources than government data. They are constantly 'polling' various sites. Their numbers are better and they have to maintain their reputation. ". . . Call them about advertising your product & find out what's going on in the market . . .".

**Other:**

She is not on the technical side. She is looking into cost/safety issues. A new contractor, Lockheed is now on-site and also Rocky flats low level wastes are involved. Most of this is dry. Her group is involved with waste treatment. JUDD ELLIS (208-526-5222 is the central INEL phone number) is a principal INEL contact. Judd understands benefits and can talk

specifically about effluent monitoring. The contractor/s for INEL is/are Lockheed (LITCO) and MM. Thermo Electron is closely involved also (Thermo Power should leverage this internal contact).

The contact at LITCO is BART KRAWITZ ". . . a forward thinker . . .". Also find the Thermo-Electron contact and talk to him directly. Talk to Judd Ellis. They (collectively) will help define the market. A multilevel/multilayered sell is involved. All DOE manager are matrixed, especially w.r.t the GOCO community.

**Transcript 14**

**Source:** **Meeting at DOE EM-HQ**

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**General:**

A well-received kickoff meeting at DOE-Germantown attended by Alexander Williams (AW), Tom Anderson (TA), Carolyn Purdy (CP), Al Tardiff (AT), and Skip Chamberlain (SC). Mood of meeting can be summarized by Alexander Williams' comment ". . . I wouldn't be here if I didn't think you had something."

**Specific:**

| | | |
|---|---|---|
| AW-Markets | = | Scrap, oil well drilling, phosphate mining, water & sewer treatment |
| AW | = | Regulatory acceptance - NRC and EPA and DOE |
| AW | = | Field sample collection = 30 min - 1 hour |
| TA, AW | - | Isotopic resolution = important |
| AW | - | 3 Key Items<br>- How good is detection - detection limits<br>- Is measurement useful - accurate<br>- Cost/savings |
| AW | - | Top-down & bottom up - selling, bottom-up most important |
| AT | - | $25K limit - above = competitive bid |
| TA | - | Took TAM questionnaires to give to INEL mixed waste people |
| TA | - | Mixed waste - go to INEL |
| AT | - | Pecking order<br>- Must conform to conventional procedures/protocols<br>- Talk to end user<br>- Talk to people in approval process |

AT - Must have TAM written into operating permit (pre-certification)

CP - ENTICE program - can participate for verification of TAM performance
- 2 Nevada EPA Labs
  - EMSL - ORD - Eric Coglin
  - Other Lab - Office of Rad. and Indoor Air
- EPA/542-B-94-010 - ENTICE document
- A solicitation for bids

AW - He sees two uses for TAM:
- Several dozen TAMS can be used in 2 types of labs: those that usually handle RAD, and those that don't handle RAD, but monitor for it
- Plumes, like at Hanford - has several 100's wells, only 6 portable TAMS might be required for Field Survey Teams

AW - EM has few point discharges
- Other (Defense Nuclear, etc.) are usually landlord and have the point discharges
- He sees a need for 1 TAM on-line with every discharge point

AW - Find a customer for Beta test, then get a focus group to fund

AW - Conferences worth attending:
- EM-40 - Environmental Restoration - August - AW
- EM-30 - Waste Management - spring (February/March)
  - Steve Domoter @ 301/903-5053
- HP Society, ANS, ASTM-D34

-TIE - Tech. Info. Exchange: conference for people that do the work

AW - Publications
- Inside DOE/EPA/NRC
- Nucleonics (week)
- Nuclear fuel
- Waste management newsletters
- Market to NRC licensees

AT - The more capabilities, the better

AW - Beta test better at an actual site, not at our lab

AW - Next week he'll get us suggestions for sites

AT - Initial suggestions
- Fernald
- SRS - DWPF-Defense waste processing facility
- Hi-level waste - EM-30 - Dave Pepson
  - INEL, Hanford, Los Alamos
- TSCA incinerator

AT, AW - They know of no current competition to TAM

## APPENDIX 2

## PERTINENT FEDERAL GOVERNMENT REGULATIONS

Water sources contaminated with or potentially contaminated with alpha emitters must comply with a number of different regulations. Key regulations include the following :

- Title 10 CFR Part 20, Standards for Protection Against Radiation (NRC)
- Title 40 CFR Part 141, 142, National Primary Drinking Water Regulations; Radionuclides; Proposed Rule
- Title 40 CFR Part 260 - 272, Resource Conservation and Recovery Act Hazardous Waste Regulations (RCRA mixed waste regulations)
- Draft DOE Order 490, General Environmental Protection Program
- DOE Order 5400.1, General Environmental Protection Program
- DOE Order 5400.4, Comprehensive Environmental Response, Compensation and Liability Act Program (CERCLA requirements for hazardous waste clean-up and notification)
- DOE Order 5400.5, Radiation Protection of the Public and the Environment
- DOE Order 5440.1C, Implementation of the National Environmental Policy Act of 1969
- DOE Order 5480.11, Radiation protection for Occupational Workers
- DOE Order 5480.26, Trending and Analysis of Operations/Information
- DOE Order 5480.4, Environmental Protection, Safety and Health Protection Standards
- DOE Order 5484.1, Environmental Protection, Safety and Health Protection Information Reporting Requirements
- Draft DOE Order 5820.2A, Radioactive Waste Management