Chapter 2

The ORNL Rad Protection Organization, 1989-1994

I began work at ORNL in November 1989. My supervisor was Joe Setaro, a former radioisotopes production manager; his supervisor was Dr. Jerry Swanks, head of the environmental, safety, and health (ES&H) organization. The contractor that ran ORNL at this time was Martin Marietta Energy Systems (MMES), so MMES was our actual employer. But as Setaro explained to me, when a contractor changed, the top levels of management also changed but all of the incumbent employees below them were hired by the new contractor. Thus the ORNL staff remained fairly constant.

When DOE issued its Order 5480.11 ("Occupational Radiation Protection") in December 1988, requiring that all sites establish a formal ALARA program by December 1989, Swanks tapped Setaro to head up ORNL's new ALARA Program. The term "ALARA", of course, stands for As Low As Reasonably Achievable and refers to the effort to reduce radiation dose not just to the statutory or regulatory limits, but as far below these limits as is reasonably achievable. The term is used by the International Committee on Radiation Protection (ICRP) and the National Committee on Radiation Protection and Measurements (NCRP), on the basis of whose recommendations DOE and other Federal agencies adopted the concept. Thus in 5480.11, DOE was requiring that a systematic and documented dose reduction and control program be established.

Years later, Setaro told me that before he was appointed as the ALARA Program manager, the then-head of the field rad protection organization, Hal Butler, had been directed by Swanks to start a formal ALARA program. Butler delayed doing so, believing that the rad techs and the few degreed people working under him provided all the rad knowledge and ALARA input necessary for work as part of their coverage of jobs and their signing of Radiation Work Permits (RWPs). Apparently recognizing that this foot-dragging showed that Butler might not provide a conscientious implementation of DOE's ALARA directives even if he were forced to start a program, Swanks then recruited Setaro to start and head up the program. Swanks trusted Setaro, who had worked for him in Swanks' operational manager days. To ensure that progress was made, Swanks had Setaro answer to him, not to Butler.

Setaro then hired Sam Gheesling and me as the ALARA program staff. Gheesling was chosen because he was an ORNL operational engineer who had a lot of "hot work" experience. I was chosen because of my 13 years at a consulting engineering firm doing design and work planning tasks for nuclear power plants -- i.e., I was an experienced rad engineer -- and I was a certified health physicist (CHP) and a registered professional engineer (PE, in Illinois). (For readers who do not understand these qualifications, a health physicist is a rad protection specialist; usually the term applies to a professional person with a degree. Both the CHP and the PE qualifications require certain educational and experience prequalifications and the taking of an all-day test. The CHP test is regarded as particularly difficult.)

I was thus the only one of the three of us who had formal rad protection credentials, but I believe that Swanks thought that it was important for the people in the ALARA Program to have credibility among the operational and research (O&R) people. Setaro not only had more than twenty years of experience at ORNL (the DOE world), he had about four years of experience at a isotopes production reactor in California (the NRC world). Also, Swanks was aware that Setaro had a proactive attitude about safety and would make the necessary efforts to get up to speed on the requirements of administering an ALARA program. Gheesling's many years of experience included planning and supervision of hot jobs such as radioactive filter and hot cell shielding window changeouts. So by having two people with long-term practical experience in radioactive operations in the DOE world, Swanks apparently hoped for a smooth relationship between the ALARA Program and the O&R groups despite the from-the-start opposition of the existing rad protection organization.

Setaro called Gheesling and me "ALARA engineers" for organization chart and procedure purposes. However, Setaro put me in the "engineering" functional title track rather than the "health physicist" track (I suppose to allow me a better chance at promotion and pay raises) and thus I was known to Human Resources as an Engineer III. Within a couple of years I was promoted to Engineer IV, the title I held until I was laid off in 2000. But whatever the functional title, the intent from the start -- soon "set in concrete" in procedures -- was that the ALARA Program would also provide radiological engineering support to the rad protection organization. This included, e.g., the specialized shielding analyses that I was experienced in and the operational and engineering expertise that Gheesling could provide. In particular, design reviews and non-routine operational reviews were to be provided by us.

To ensure that we were up on DOE's intent and on current practices in safety and ALARA, Setaro sent us to a very useful four-day DOE safety course. All three of us also went to various national and local DOE rad protection meetings in those first few years. Within ORNL, we started attending ORNL operational planning and design meetings and participating in incident evaluation meetings. However, while we made some headway in acceptance among the O&R people, the sustained opposition to our activities on the part of the rad tech organization slowed things down..

The ORNL Rad Protection Organization

To understand how the safety culture evolved at ORNL and how the problems in safety management consequently arose, one must first understand how ORNL was organized, particularly the rad protection organization. From talking to ORNL old-timers, it seems clear to me that there was always a professional health physics involvement in ORNL work. Part of this arose from the pioneering work done at ORNL in health physics; indeed, it can be argued that health physics as a discipline was partly invented at Oak Ridge, which had many of the health physics "titans" of the 1950s, 1960s, and 1970s.

But at some point it was decided to split what we might call the "theoretical" branch of the health physics organization off from the "operational" or "field" branch. The theoretical branch -- which over much of the time I was at ORNL was called the Health Sciences Research Division -- was composed primarily of degreed professionals who did studies, made comparison measurements on dosimeters, etc., and also did some health physics surveys and field work at non-Oak Ridge sites on a contract basis. The operational or field branch was called the Environmental, Safety, and Health (ES&H) Directorate headed, as I noted, by Swanks when I came to ORNL. ES&H was thus the branch that actually provided rad protection coverage for ORNL operations and facilities.

There were two health physics sections in ES&H. One section, the bioassay and records people, issued and read the dosimeters, performed measurements of internal radioactivity using the whole-body counter and radiobioassay techniques (e.g., on urine samples), and kept dose and related records. This section included various professionals who did dosimetry, managed the various health physics labs, etc. The other, the "surveillance" section, included the operational rad techs, who covered the jobs and operations; their foreman-like supervisors, called complex leaders; and the complex leaders' supervisors, called group leaders, who answered to Butler. A few of the group and complex leaders were professional health physicists who also did analytical and evaluative work such as shielding calculations and dose evaluations, thus being involved in the day-to-day work of the division at the same time as they served as Butler's brain trust. As these people retired one by one, however, the remaining and new complex and group leaders were less likely to have degrees and they usually did not have significant experience in doing complicated calculations (e.g., in performing computer shielding calculations) or in reviewing and contributing to design and operational documents.

One reason for hiring only experienced senior people with degrees into the ALARA program was to provide additional professional and especially rad engineering support for the division. But in 1990-91, Butler, reportedly because he was miffed at having the ALARA Program set up independent of his section, hired two people that he called "radiological engineers", Kurt Geber and Richard Utrera;

neither one had any rad engineering experience or was a certified health physicist but both had master's degrees in, I believe, health physics. Utrera was fresh out of graduate school, but Geber had had some work experience in a hospital nuclear medicine department. Butler did not define specific functions or qualifications for them; they were to provide some vague "support" on an ad hoc basis. In this way, he tried to preempt the rad engineering functions that were supposed to be, and soon were procedurally, assigned to the ALARA Program.

Due to these historical events and some later political ones, Butler and others in his section felt that the ALARA program had been imposed on them and that the ALARA staff were interlopers in field work. It seemed to become necessary for some of them to deny the importance of professional qualifications (i.e., of degrees, higher-level training, and experience) in the detailed review of designs and operations. Many in the surveillance section seemed to regard the HSRD people as "ivory tower" types and in later years referred to the field-theoretical split with satisfaction; these people similarly referred to the ALARA staff as people not in touch with operational reality and they denigrated our efforts. They became very class-conscious regarding professional versus technician qualifications. Especially with regard to planning and authorizing work, they were emphatic that the qualifications of those who had spent their careers actually in the field covering jobs were superior to those who had not, irrespective of the nature of the work or the degree of analysis or evaluation required. Those who believed this also tended to advocate exclusion of ALARA staff when O&R management or the rad techs requested it. This attitude was so pronounced that although the two health physicists with the title "rad engineers" (Geber and Utrera) were part of the surveillance section, they too experienced exclusionary treatment. I heard various derisive comments about them from rad techs and complex leaders, particularly about the more senior and experienced Geber -- comments to the effect that they were ignorant of how things worked in the field. But no effort seemed to be made to provide them with field experience, such as assigning them to work in particular facilities for a few months alongside the rad techs.

Setaro managed to make operational review functions part of the ALARA program in the rad protection procedures -- first as per DOE recommendations and later as part of fulfilling DOE Rad Con Manual requirements. These reviews were to be done by the ALARA engineers rather than the rad tech organization for two reasons. First, the ALARA engineers could understand and evaluate certain aspects of the work that the rad techs couldn't, or at least that the majority of them couldn't. Second, rad techs tended to be assigned for extended periods of time to a single facility or group of facilities and usually to a single operating division; they tended to identify with the people and the work of their facility and so were not always reliably objective about the work. In the past it had been possible for some O&R managers to persuade the techs that certain practices or ALARA interpretations were okay when they were not. The ALARA engineers were less subject to this since they were fewer in number, looked at work in many different facilities, and kept up better with lessons learned at the site and around the DOE complex; they were thus more independent and usually more informed as to actual DOE requirements. Certainly many of the rad techs were fair-minded and independent in their coverage, but the exceptions were neither few in number nor minor in effect.

The operational review was supposed to be done as part of work planning and before work started. This type of review was beginning to be performed widely around the DOE complex), with some sites already doing it for years. But at ORNL, the review was seen as an extra step in the work planning process, so although some O&R people were cooperative, others resented it, denying that it "added value". Some rad techs, complex leaders, and group leaders helped feed this resentment by criticizing the operational review process when they were speaking to the O&R people. In particular, they began to characterize the review process as something that the ALARA people were inflicting unnecessarily on the O&R people. We knew they said so because some of the O&R people told us about it.

Butler himself resisted having ALARA engineers involved in operational reviews on the grounds that the rad techs, complex leaders, and group leaders did an adequate review job and his rad engineers, Geber and Utrera, could take care of anything that the tech folks could not (although at this point Geber and Utrera were inexperienced and did not seem to have an experienced and active mentor). Butler's hand was strengthened when Swanks was promoted to associate director of ORNL and Butler was made acting head of the entire rad protection organization, including the ALARA Program and the dosimetry and records section. Dr. Ronald Mlekodaj (pronounced mal-KOH-dee), a group leader and certified health physicist, replaced Butler as the surveillance section head. Although Mlekodaj did not seem to take sides in the friction between the ALARA Program people and the rad tech organization, neither did he seem to be interested in resolving the situation.

ORNL's rad-techs-versus-rad-engineers dichotomy (which prevailed until the ALARA engineering group was dismantled at the time of my layoff in 2000) thus originated to a large extent in Butler's effort to minimize the ALARA people's role in operational decision making and operational contact and to maximize his rad techs' role. (I use the term "rad engineer" here to indicate both the rad and the ALARA engineers because eventually Butler's "rad" engineers were grouped with the ALARA engineers and because the ALARA engineers were doing rad engineering.) But it also had some roots in the age-old conflict between the technician-level workers and the specialized or advanced-level workers. Experienced rad protection professionals at large DOE- or NRC-regulated facilities will recognize that there is a certain class distinction between the rad techs and the rad protection professionals.

In the case of rad protection, there were several ways in which the rad tech vs rad engineer or rad tech vs professional health physicist tension manifested itself at ORNL. First, like a good craft worker, a good technician of any kind is worth his weight in gold. This is because such work also requires an aptitude for consistent application of often repetitive combinations of physical and mental skills, because such work requires a good sense of what can be handled locally (so to speak) and what has to be bumped up to higher authority, and because a supervisor or manager can't provide constant in-person oversight and control. All of this is particularly true of field work, which by its nature takes place away from headquarters. Thus on a day-to-day basis someone is needed to do that work who is well-trained and reliable -- someone who shows up on time prepared to get right to work, who doesn't cut corners or fudge on documentation, and who can distinguish between decisions he can and should make himself and decisions he needs to refer to others.

In rad protection, good training is a start in making such a person, but it is only a start; experience adds a great deal of specific knowledge. For example, if radioactive material is being worked with by an operator, the rad tech needs to know if the material is in solid or powdered or liquid form, whether it is being worked on in a glovebox or a fume hood or a laboratory benchtop, and so forth. He needs to observe the specific techniques used, such as how a waste bag is sealed, and to know why they are used, as a guide to determining if they are adequate in this case and as a basis on which to determine adequacy in future cases that are similar but not quite the same. Thus a good technician needs to have experience not just in doing the standard things he was trained to do -- taking dose rate readings, for example -- but also in the particularized features of varied operations. At ORNL, there were many crack technicians who were very knowledgeable about the operations they were assigned to because they did pay attention to the particular features of the work.
However, some technicians, having gotten to the point where they know or think they're good, may be scornful of those with less knowledge or with alternative knowledge, in particular those who have not had the same degree of experience covering actual jobs on a real-time basis as they have. At ORNL, this type of experience was largely what the rad techs called "having field experience". A principal criticism leveled at the rad engineers was that they "had no field experience". This, it was claimed, should preclude the engineers from participating in operational reviews, as if on-the-spot coverage of past rad jobs was the only knowledge of value in assessing the adequacy of rad protection in planning future operations. This was even brought up with regard to design reviews, i.e., some techs claimed that those who had "no field experience" could not tell if a proposed design was

practical or not and so their opinions were worthless. I will discuss specific instances of this attitude later in this book, so that the reader will understand the particular circumstances in which these claims were made.

I will add here that although the reader will find me critical of the rad tech organization in many places in this book, I do believe that a good group of well-motivated and well-trained techs is essential in a rad protection program. As I have often said, the most important single factor in avoiding serious dose is a well-(rad-)trained worker, but the next most important is having a good tech covering his work. In some cases, having an alert, conscientious tech is even more important than having the worker be rad-experienced. Many techs I knew at ORNL were ace techs, as I noted above. Several of these, at one time or another, told me that they recognized that they had their role and we rad engineers had ours; they said we were all on the same rad protection team and they wanted us all to work together. Thus there was obviously a subgroup of techs who thought that rad engineers did serve a useful purpose and did "add value", even though the rad tech "party line" said the opposite.

A second way in which the tech vs rad engineer tension showed up was in how each side viewed the value of training. ORNL had an excellent rad tech training program. However, with few exceptions, all of the formulas, survey techniques, rules of thumb, and applicable regulations were known to the rad engineers as well, learned as part of their training and work experience. The training of the rad engineers went much farther than that, of course. But many rad techs tended to denigrate the value of training beyond the level of rad tech as being "book learning" or "knowledge on paper" rather than knowledge with a practical application; many did not seem at all interested themselves in further training or additional information, while the rad engineers were usually eager to take further training or attend professional conferences. Some rad techs had gained additional knowledge from self-instruction or from informal mentoring, but since this sort of acquisition was not validated or verified (e.g., by formal testing or certification), the rad engineers were leery of accepting these people as peers in the particular area of knowledge, although they respected their competence in the tech-specific areas. An example of this was in shielding calculations: some techs and tech supervisors used lookup tables and the Microshield code, but when I talked to them, they seemed unaware of the limitations of such tables and the code, such as in their use of a broad-beam lookup table for point-source geometry cases.

A third way in which the tension showed up was in the area of pay. This was not just a question of who was paid more, but of where the money to pay them came from. Most of the techs' time was directly charged to the O&R divisions for which they worked. Most of their supervisors' time, at least after some point in time, was charged as a surcharge on the techs' time, i.e., the tech charge rate included an allowance for their supervisors' time. But the ALARA engineers were paid out of the ALARA Program budget, i.e., they were essentially on overhead, and I believe that the surveillance section rad engineers' time also was mostly on overhead. Some of the time was direct-charged to a project if the project was considered to need "extra" time, but mostly the engineers' work was paid for by the O&R divisions only via their payments to ORNL overhead. Because the techs were paid for by direct charge, many techs and their supervisors seemed to regard their services as more desirable to the O&R divisions and more justified as well; they regarded the rad engineers as parasites who could be supported only by ORNL and DOE higher managements' political decisions and not by their own desirability or worth. This attitude seemed to be conveyed to managers in several O&R divisions or at least was shared by them, since we rad and ALARA engineers began to hear this eventually from those managers as well as from the techs and their supervisors. This attitude, which did not seem to be corrected by the rad tech management, was critical in determining the direction of the rad protection organization in the future.

For about a year, the ALARA Program added an additional rad protection professional, making three under Setaro. The new person tracked and trended doses and other rad protection indicators. But she had too little involvement with direct operational issues to keep her interest and eventually tired of

being what she called "The Database Queen". When she left, she was not replaced, although we needed someone to do the work. A graduate student helped on a part-time basis for another year, but after that, the tracking and trending was somewhat episodic due to the lack of personnel.

At least up until I was laid off in December 2000, the O&R divisions operated in many ways as fairly autonomous units, even as little fiefdoms of their individual managements. I was told by old-timers that this was true long before I came. Some of these divisions chafed loudly under the centralized control of ORNL and, especially, MMES top management. They felt that they were “taxed” to contribute to ORNL overhead (which at that time was almost 40%), without receiving what they regarded as commensurate benefits back. Some expressed the opinion that although economies of scale might be realized in some areas by centralizing, this centralization had not produced such economies in other areas, such as craft work. Others did not agree that it was best to have a centralized safety organization answering to top ORNL management; they would have preferred to have their own people do safety functions as much as possible and to hire safety subcontractors directly for the rest. They were allowed to have division safety officers for industrial hygiene and industrial safety coordination and division rad control officers for radiation protection coordination, but not to hire their own safety and rad people to duplicate the functions of the central ORNL safety organization, nor were they allowed to hire subcontractor safety people directly. Thus, for example, when temporary subcontractor rad techs were needed, they were subcontracted, trained, and supervised by the ORNL rad protection organization rather than by the individual O&R division to which these techs would then be assigned.

Besides the rad protection organization itself, there were some O&R division people involved in the conduct of the ALARA program. Setaro set up two ALARA committees, called the ALARA Working Committee (AWC) and the ALARA Steering Committee (ASC). The AWC was composed of a member from each of the O&R divisions performing significant rad work; in addition, there was a member who represented the bargaining unit (i.e., the unionized craftsmen). Setaro, as the ALARA Program manager, acted as chairman of the AWC, which met monthly. The higher-level ASC was composed of the division directors of the corresponding O&R divisions represented in the AWC; the head of the nuclear safety organization (which covered what I call "significant accident" analysis and documentation); the head of the rad protection organization (initially Butler); and the ALARA Program manager. The designated chairman was initially Swanks, but later, when he became "too busy" to attend the quarterly meetings, his deputy became the ex officio chairman. The idea was that the AWC would discuss working-level issues, approve ALARA awards, and recommend radiological goals to the ASC; the ASC would generally set rad protection policy as regards dose reduction, would approve proposed deviations from the site dose limits, and would investigate any significant problems. The ALARA Program staff -- initially Setaro, Gheesling, and I and our secretary -- were the committees' support staff and prepared the written material for the meetings.

But here too the idea of each division's being its own little fiefdom entered. While at other DOE sites and indeed at non-DOE sites there was usually one ALARA committee and it was empowered to review and approve proposed major operations and projects, at ORNL the powerless AWC was only "briefed on" operations and projects and never undertook to "review" them, much less approve them. The ASC, since it consisted of busy division directors and met only quarterly, mostly also was merely briefed on what was going on. The ASC had power but usually declined to use it except to make small adjustments to radiological goals. The ASC did have to review and approve the receipt by named individuals of annual dose beyond the site goals, but it virtually always did give approval, thus routinely accepting the case made by the division requesting the increase. I do not think that Setaro intended for this situation to occur when he set up the dual-committee system, but over the first year it became clear that his consensus approach to running the committees -- to allow the divisions to provide the briefings on their own work and to do it on their own schedule and at their chosen level of detail -- was enabling the divisions to continue to go their own way and avoid committee inquiry into their operations. This frustrated Setaro, but he gamely continued to work on the problem, trying

to win the divisions over little by little. I believe that Swanks could have solved this problem but chose not to do so.

DOE-Sponsored Appraisal of Oak Ridge Radiation Protection

In a 26 September 1992 report, DOE gave the results of a 1989 appraisal of the rad protection program at the three Oak Ridge sites run by MMES: ORNL (aka X-10, almost entirely nondefense research), Y-12 (the weapons production site), and K-25 (the mostly shut down Oak Ridge Gaseous Diffusion Plant). (There was no reason given for the delay between the actual appraisal and the issuance of the report, but reports like this could sit in DOE hands for ages before being approved.) The appraisal team -- a "Tiger Team" -- was composed almost entirely of contractor employees from other DOE sites; they were from companies different from MMES and were all established in their various areas on the rad protection field. So although the appraisal was done under the aegis of DOE, it was actually a peer review. The appraisal was of the oversight by DOE and by the central MMES organization that ran all three sites and of functioning of the rad protection organization at each site. I describe the findings here because of their significance with respect to what I would report to DOE years later.

Overall MMES deficiencies were given as lack of adequate and qualified staff; lack of an effective training program; lack of positive controls and verification of safety in the workplace; inability to deal effectively with large radiological accidents (as shown by poor performance on simulated emergency exercises); and failure to conduct self-appraisals. It was noted that there was no MMES policy in the areas of safety review and approval of work packages and that "the ratio of radiation safety (health physics) personnel is disproportionately low as compared to other comparably sized facilities within the nuclear community". Local DOE oversight staff was cited as lacking adequate direction and training to carry out safety management and oversight responsibilities.

The report stated that MMES Central had no policy to establish that ES&H would be involved in the review and approval of all "high-risk" work; at all three sites, it was the facility manager or facility engineer (i.e., the operating group) who determined the need for ES&H review and who alone approved work packages. MMES Central had only one individual performing health physics and industrial hygiene oversight. MMES had approximately 1% of its badged staff assigned directly to health physics positions, while "industry experience has shown that commercial reactors begin to have radiological protection problems when their health physics staff drop below 5% of total dosimeter-badged" personnel. The report conceded that a direct correlation could not be made between commercial reactors and DOE Oak Ridge facilities, but argued that some aspects were the same or quite similar and that given "the unique operations at MMES facilities, such as ORNL, a larger proportion of professional health physicists would be expected". Tables in the report gave the information below.

Oak Ridge Radiation Protection Personnel Statistics, 1988 and 1989

	Y-12		ORNL		K-25	
	1988	1989	1988	1989	1988	1989
MMES						
Radiation Workers	387	375	369	407	469	461
Nonrad Workers	6591	6475	4993	5030	2225	2338
Total Badged Workers	6978	6850	5362	5437	2694	2799
Professional HPs	11	19	34	42	3	7
Rad Technicians	18	33	42	39	7	8
Contract Techs	N/A	N/A	N/A	5	0	17
Total HP Personnel	29	52	76	86	10	33
Ratio, HP Techs/professionals	1.6	1.7	1.2	.93	2.3	3.6
Ratio, HP personnel/badged workers	.0042	.0076	.014	.016	.004	.012
MMES + Other (Subcontractors)						
Radiation Workers	430	355	438	444	469	462
Nonrad Workers	10186	8724	7144	7056	2757	2802
Total Badged Workers	10616	9079	7582	7500	3226	3264
Ratio, HP personnel/badged workers	.0027	.0057	.010	.011	.003	.010

The report said that the ORNL "field Health Physics Section" (apparently the rad tech and dosimetry-records sections together) had "31 professional health physicists and 25 technicians". Presumably all the rad tech supervisors (complex leaders and group leaders) were counted as professionals, but even so, it is difficult to see how they arrived at a number as high as 31. In any case, it was noted that no management review had been performed to evaluate staffing levels "to ensure that an adequate margin of safety is being provided in the workplace". The term "adequate margin of safety" was not defined quantitatively (it seldom is in the DOE world), but suggested a level corresponding to comfortably above the barely adequate.

It was noted that all three plants lacked a definition for "Controlled Area" and a method for calculating the effective dose equivalent, both of which were required by DOE Order 5480.11. It was noted that there was "a lack of understanding of the importance of a well-defined program for the development and control of operating procedures in relation to radiological safety commensurate with the hazards", e.g., MMES people were casual about writing and issuing rad work procedures and ORNL had used unauthorized procedures. The ORNL Radiation Work Permit (RWP) procedure was found to set a radiological action level for generating RWPs that was "too high": a dose rate of 1 rem/hr or an anticipated dose of greater than 20 mrem in a shift. But at least ORNL had an RWP procedure; Y-12 and K-25 did not. ORNL had a health physics manual of procedures, but the appraisal team noted inconsistencies in the level of detail and approval requirements for job-specific rad protection operating procedures: "some procedures were limited to a single paragraph of detail and had no indication of review or approval".

Both MMES and ORNL took a hit in this report for their rad protection instrument deficiencies. It was noted that ORNL had approximately 1000 instruments in use, some 80-90% of which had been fabricated 10 to 20 years earlier at ORNL and none of which had been tested against ANSI criteria. Beta and low-energy X-ray response had not been established for high-range instruments -- a significant potential source of error -- and field area monitors, friskers, and counters were not calibrated over their full range or as alarm devices. There were no written calibration procedures. The report authors thought that air monitoring information was likely to be unrepresentative of the actual conditions, because (1) air monitors used throughout ORNL had been shown to suffer from inleakage problems, (2) ORNL's approach did not provide sampling at representative locations but rather at "convenient" locations, (3) losses due to self-absorption, etc., were ignored, and (4) the

equipment was old. Also, the air sample activity limit was a fixed 100 pCi alpha or 1000 pCi beta no matter in what facility or position the air monitor was located, which, as the authors pointed out, represented varying concentrations based on sample collection time. The report noted that the rad techs were not trained in the proper use and interpretation of rad protection instrumentation.

Some appraisal team members watched several jobs being performed. Of a manipulator repair in an ORNL glovebox, they said that the building health physicist responsible for controlling the activity did not know when the worker left for the day and that the RWP for the work had not been approved by the line (operational) supervisor. Other deficiencies were inconsistent placement of finger ring dosimeters; variable selection of protective clothing; and failure to report whole-body dose rates on the RWP and to calculate an estimated whole-body dose. The appraisal team saw some unwrapped and unprotected equipment in a posted contaminated area out in the open; the items had been stored for over two months and had beta-gamma removable contamination levels up to 40,000 dpm per 100 cm^2. The appraisal team asked questions of rad protection personnel and received answers from at least one lead rad tech that indicated a lack of knowledge regarding radiation hazards and standards.

The report concluded that significant underreporting of potential intakes was likely. Since the air filters, nasal smears, and surface contamination smears were counted by the rad protection complex personnel (rad techs), the complex leader was responsible for using the results of the counts and air monitor data to originate a preliminary report. Thus at ORNL, the report stated, "diverse and informal criteria for initiating the occurrence report process are implemented by the complex leaders". The appraisal report noted an incident in which a torn glove led to a skin contamination, yet because the air monitor did not alarm, no report was filed and no bioassay requested. The reader should note that the phrase "diverse and informal" implied that each area or person had its own criteria, possibly not even written down.

An incident that occurred at HFIR, the research reactor, was particularly noted: a worker received 22 mrem while working without an RWP. The authors cited this as an example of a failure of both controls and ALARA. Since the incident occurred before I came, I heard about it only from ORNL people before I saw this report. The observation by the appraisal team that this was a control failure was quoted to me by some O&R personnel as an example of DOE silliness and failure to be in touch with "the real world". That is, the O&R personnel focussed on how little 2 mrem was, in terms of exceeding the 20-mrem procedural trigger for requiring an RWP, and how little the whole 22 mrem was. So the team's conclusion seemed unreasonable to me too -- until I saw from the report that the dose rate was 450 mrem/hr, a substantial dose rate for a working area and well within the dose rate limit at which an RWP should have been written. True, the dose outcome was low, but as the team correctly diagnosed, the potential for some serious dose was there, especially given the procedural and other deficiencies cited by the authors (who were, remember, peer reviewers).

One of the criteria against which the team evaluated the sites was "strong support" in activities such as ALARA implementation, rad engineering, safety analysis documentation, and operation safety requirements because "these activities provide reliable analysis of radiological hazards and documentation to ensure the largest margins of radiological safety in the workplace". The team said that MMES had not provided "specific direction, guidance, or policy relative to the implementation of an ALARA program", which was clearly necessary to fulfill 5480.11 requirements. They noted that a qualified ORNL ALARA coordinator (Setaro) had been appointed, but his charter and responsibilities had not been formally approved. They also thought that application of ALARA principles was "largely dependent on overview of facility activities by a safety overview staff and the Radiation Operations Committee". (I note here that they did not mention that this committee did not cover the reactor -- there was a different oversight committee for that.) The "safety overview staff" focussed on accident analysis, not on dose control in routine operations, but presumably this was all the team found as higher-level oversight. They also judged that ALARA principles were "not well established among workers" and that work did not always receive "an appropriate level" of

ALARA review. They cited the example of a worker suggestion to use a chute to transfer waste instead of handling it manually; this was said to have been vetoed by a rad tech on the grounds of contamination concerns and was not evaluated by, e.g., a rad engineer or senior health physicist. The authors concluded, as a "Concern", on the basis of this and other evidence that "Radiological work procedures and ALARA dose reduction opportunities are changed or vetoed by field personnel without proper review of the facility safety group [the safety overview staff group] and/or review by the Radiation Operations Committee".

Various other ORNL deficiencies were noted, including unposted open neutron beam areas at HFIR; lack of as-built drawings; failure to establish controlled areas as required by 5480.11 (instead, there were vaguely defined "regulated areas"); use of uncalibrated neutron and extremity dosimeters; failure to involve internal dosimetrists in the preparation of the 5480.11 implementation plan (despite its new requirement for addition of internal and external dose to produce the total dose); and a less-than-adequate emergency exercise in response to which various persons apparently questioned openly their need to participate. There were no approved Safety Analysis Reports or Operational Safety Requirements for facilities handling transuranics. The report stressed as a "Concern" that facilities handling transuranics and transplutonics (e.g., the REDC facility) did not meet the requirements of DOE Order 6430.1A (the omnibus general design criteria document) and did not meet "requirements imposed on similar facilities at other DOE sites". An example was that most ORNL room or facility exhaust systems handling transuranics and transplutonics had only one stage of HEPA filtration.

ORNL did get some attaboys in the appraisal report: the near-term establishment of an instrument calibration facility, the evident competence of ORNL's lead internal dosimetrist (Liz Brackett -- you go, girl!), and the ALARA coordinator's (Setaro's) awareness of ALARA program elements were all noted.

The deficiencies cited by the Tiger Team in DOE's oversight of rad protection at the Oak Ridge sites included lack of qualified DOE rad protection personnel and, especially, the slighting of oversight and appraisal activities because of time spent on technical support. The local DOE office, DOE-Oak Ridge Operations, had also issued a contamination control policy that was "inconsistent with DOE 5480.11".

The Reactor Operations Review Committee (RORC)

One of Setaro's aims was to gain rad protection representation on the various internal committees having oversight of activities involving radioactivity. He was chairman of the AWC and his boss was the chairman of the ASC; Sam Gheesling was on the aforementioned Radioactive Operations Committee (ROC), which provided oversight of nonreactor operations; and in 1991, I was appointed as a member of the Reactor Operations Review Committee (RORC), which provided oversight of reactor operations. I was chosen for this committee because of my experience in the commercial nuclear power plant world, particularly with regard to nuclear safety reviews and design.

Reorganization of the Rad Protection Organization and the Birth of ORP (1992)

In late 1992, Swanks was promoted to associate director of ORNL, Butler retired, and the ES&H organization was divided into "offices", which were quasi-equivalent to divisions. The rad protection organization was renamed the “Office of Radiation Protection” (ORP). The new ORP director was Dr. C. Steven "Steve" Sims, who had worked in HSRD for many years. Dr. Sims is an affable person with health physics "chops": besides all his research activities, he was and is active in committees of the national Health Physics Society and he is a longtime associate editor of the Health Physics Society's technical journal. Although he is not a certified health physicist, I always felt that that was because he simply had never gotten around to taking the test.

Some time after the reorganization, Setaro left ORP to become an aide to Swanks. For about a year, Gheesling and I carried on the work of the ALARA Program by ourselves. Ostensibly we were supervised by Mlekodaj, now serving in a dual capacity as head of the surveillance section and of the

new Radiological Controls Section (which included us). In the latter capacity, he was the ex officio ALARA Program Manager and thus the ex officio chairman of the AWC and the facilitator-member of the ASC. But his office was on a different floor of our building and seemingly on another planet. He ignored us and was uninterested in rad engineering and ALARA issues. I believe that over this period, the hostility of the tech organization toward rad engineers gained strength because of his indifference to these attitudes.

In addition, he was not supportive in our dealings with our secretary, who was lazy, devious, and scatterbrained. Setaro had hired her about two years earlier and soon regretted it; he thought that her old division director had snowed him in order to offload her onto us. The move was a promotion for this woman, one she clearly did not deserve. For example, one afternoon I gave her a note about where I was to be in a meeting and also told her orally where I would be. Later, I found out that while I was in the meeting, my daughter's school called to say that my daughter was ill and needed to be picked up. A coworker told me that the secretary (who had mislaid my note) was wandering the halls of our building that afternoon asking everyone she met if they knew where I was. There was no chance that she would be able to find me: not only was it a huge building, I wasn't even in it. Mlekodaj just sighed over this incident and refused to do anything. Gheesling and I tried to document the secretary's various offenses, as personnel procedures would require if an effort were ever made to have her transferred or fired, but Mlekodaj was not interested in pursuing that. So we ended up doing most of our xeroxing, etc., ourselves rather than giving it to her and having to redo much of it later. The secretary had one important function in the ALARA Program: to take notes of the meetings of the two ALARA committees and write up the minutes. All but one of the other secretaries we ever had, permanent or fill-in, could do this reasonably well after several meetings, but she never could, even when the meetings were taped for her benefit. Usually she would turn out an initial version of the meeting minutes, which looked as though a third grader had written it. Then one of us had to pretend to "correct" it, but we always ended up rewriting the whole thing. We began to give her a computer disk with the new version on it (she once lost the disk and I had to make another one). She would put on a heading on our product and proudly issue the minutes with a standard cover memo, as if she had written them herself. More than once she forgot to change the date on the cover memo and minutes; red-faced, we had to reissue a corrected version.

I mention the case of the secretary not only because she was a significant drag on our productivity, but also because it illustrates how incompetence could be tolerated at ORNL if those on whom the impact fell were not important (such as Gheesling and I) and if the person in charge did not want to bother. The reader should compare this case to later cases of transferring, firing, and layoff that I will relate.

Later in the reorganization, Sims had to decide who would head up the new ALARA Engineering Group (AEG), which would be part of the Rad Controls Section under Mlekodaj and whose functions would include those previously part of the ALARA Program staff responsibilities. He spoke with various people one by one, including me, about who would be appropriate to head such a group. He told me that a new group would be created and, in general terms, whom it would include; I do not recall any discussion about functions. He asked me about perhaps two other people as possible candidates. Then he said, "What about Janet Westbrook? Would she be an appropriate person?" It seemed odd to be asked about it in this fashion; I thought he should have made it clear that I was or was not a potential candidate, even as a long shot, right when I entered the room. And I thought he should have asked me directly, as "What about you, Janet? Would you like to be considered for this position? Given your experience at ORNL so far, what would you do if you were in charge?" I forget what I said in the first part of my response, but I remember well what my last sentence was. Mindful of how the rad tech organization seemed to run the show in rad protection and how Gheesling and I had been left to fend for ourselves for so long (although I did not say that to him), I concluded by stating that I would not consider taking such a position if I was not assured of the full support of my management.

I do not know whether I was seriously considered for the position, but truthfully, I would not have wanted it. I did not want to have to deal with budgets, personnel matters, etc., as the bulk of my work; my interest was in the technical area and in the area of policy formulation, such as approaches to regulatory compliance. I don't feel the need to create my own little empire or pull other people's strings, although like everybody else I like it when people choose to do things the way I prefer or recommend. It is a gift to be able to head up an efficient, humming little beehive, a gift that I don't think I possess, at least not to the degree that the many talented managers I have seen do. As I have always told everybody, my only professional ambition was to be a senior technical person, with the stature and credibility that that would carry with it. I actually had senior status when I got to ORNL, but I felt I had truly arrived at my goal after I had some ORNL experience and was promoted from Engineer III to Engineer IV. So I was already where I wanted to be -- except for my group's problem of not getting any respect, of course -- and I did not aspire to become a supervisor.

Soon after my conversation with Sims, at the end of 1993, he gathered all of us new ALARA Engineering Group (AEG) members together and told us that our group leader would be Dr. Gloria Mei, whose previous ORNL work had been mostly special projects in dosimetry in the dosimetry and records section. As far as I could tell, Mei had no rad engineering or operational health physics experience, although she did have experience in doing some shielding calculations in her PhD years and in doing dosimetry calculations at ORNL and elsewhere. She also did not seem to have any supervisory experience. But I knew her slightly and I thought that she would get along with everybody.

She had one disadvantage that Sims seemed to zero in on: she was a native of Taiwan and spoke English with an accent. This did not bother me, since I had had a Taiwanese roommate in graduate school and I was used to the accent. But Sims announced, as if to relieve any worries anybody had, that Mei was going to take an English improvement course right away to help prepare her for her new job. Gheesling muttered later that there was no need for Sims to embarrass Mei by announcing this to all of us en masse; he could have arranged with Mei quietly for her to take the course, which we would all have found out about anyway. I agreed with Gheesling. However, as I got to know Sims better, I realized that he thought that telling everyone right away was best for everyone: he had discussed it before the meeting with Mei, of course, so she wasn't taken by surprise, and he was trying to smooth the way for her being accepted by telling us of the effort she was going to put forth to be successful. This was not the only time that I saw Sims do something with good intentions that some of his underlings regarded as ham-handed or insulting. But it was the first time that I realized that Sims could be candid to the point of indiscretion -- a very important characteristic in terms of my finding things out in the future. I must point out that since I am a "speak the truth and shame the Devil" type of person myself, Sims' candor was one of the characteristics I liked best about him.

Effective 1 January 1995, ORP was finally reorganized into three sections -- the Radiological Surveillance Section (RSS, the rad tech section), now headed by Jerry Hunt; the Radiological Controls Section (RCS), headed by Mlekodaj; and the Radiological Dosimetry and Records Section (RDRS), headed by Dr. Myint Thein. Hunt, a certified health physicist, had occupied a position at Y-12 analogous to Sims' new position, i.e., head of rad protection; it was not clear why he chose to take a lower position at ORNL, although he once told me he wanted a change from the stress of his Y-12 job.

At this time, the complex leader for REDC, the transuranic processing and development facility, retired and was replaced by Gary Kelly, a long-time REDC rad tech. Roger Davis, a long-time HFIR rad tech, became the HFIR complex leader. Dale Perkins, the HFIR (reactor) complex leader, became the HFIR-REDC complex group leader, with Kelly and Davis answering to him and he to Hunt. Rad tech Pedro Gonzalez took over as complex leader for the Holifield accelerator; rad techs Jo Ellen Francis and Betty Slaten were also promoted to complex leader. I mention them here since they all figure later in my narrative.

Within Mlekodaj's new Rad Controls Section (RSC) were four groups and two special projects people. One group was the rad tech training group (two people); they were put into Mlekodaj's section, I believe, to maintain independence from the tech section -- the trainee section, so to speak -- within the rad protection organization. Another group was the procedures and computer support group, headed by R. Vince Bishop; in addition to maintaining our divisional computer network (including the computerized Rad Work Permit system), they maintained the ORNL health physics procedures and the rad tech procedures, including the new computerized procedures review and comment system. The third group was the ALARA Engineering Group (AEG) under Mei. AEG included the "ALARA engineers" as one subgroup and the three rad technicians who handled source control and X-ray machine inspections as a second subgroup. The fourth group was the instruments calibration people. Finally, the special projects people, who answered directly to Mlekodaj, were Dr. Don Gregory, who had come to the rad protection organization from the Physics Division a couple of years earlier when the latter was shrinking due to loss of funding, and Steve Hamley, a former rad tech who had obtained his degree and had begun to specialize in conduct of operations. Gregory also stepped into Mlekodaj's old role as chairman of the Health Physics Instrument Committee. Given their functions, it was strange that Gregory and Hamley were not in AEG. I never found out why they were not.

There were some political issues involved with the reorganization. First, Bishop had been a rad tech complex leader at the HFIR facility. He had come to ORNL after working at a nuclear power plant and was an able and energetic person. At HFIR, he had started computerizing the rad work permits and introduced other time-saving computerized practices. Some people thought he was high-handed. I myself tangled with him sometimes, but I admired him for his strengths as a leader and expected him to rise in the rad tech organization. However, there were some elements in the rad tech organization that appeared to dislike him intensely, mostly from complexes other than his own. He was in line to become a group leader, but -- or so I heard -- the opposition to this was so strong from these elements that the position was denied him. I was surprised when he agreed to head the procedures and support group, thus leaving field work. When I asked him why, he alluded to his blocked promotion by saying that heading the procedures and computer support group was the only way he could be promoted.

Second, the rad engineering subgroup members, including Geber, Gheesling, Utrera, and me, were now all called "ALARA engineers". As I noted, some rad techs used to make fun of Geber and Utrera. Now Geber, but not Utrera, continued to be disliked by the rad tech organization of which he had been a part -- some called him "Goober" behind his back. (A goober, in the South, is a peanut.) In the early years, he was something of a smart aleck who liked playing practical jokes. Utrera was better liked because he was more of a buddy type. Utrera was pleasant but seemed to me to be rather unengaged in the work, intellectually speaking; for example, if a point of procedure interpretation arose, he was likely to shrug and let other people hash it out. Both Geber and Utrera still seemed to be regarded by the rad techs (e.g., in comments to me) as wet behind the ears and ignorant of practical matters, even though both had qualified as rad techs when they were in Butler's organization. Shortly after the reorganization, Geber, Utrera, and I met and went over how we did things, in effect beginning the task of reconciling and synchronizing our basic approach to rad engineering work. We also met with Mei to discuss consistency in shielding basis determinations. I was happy about this because we would no longer be working in parallel, duplicating functions and being regarded as rivals -- now we would present a united front.

Mei, who as I said seemed to have no operational health physics experience in rad work, appeared even more than Geber, Utrera, or I to be regarded as an inhabitant of the ivory tower who knew little that was not learned in a book. Thus Sims had chosen as the AEG leader someone who, although she turned out to be (in my opinion) a good people manager who got along with everybody, had no credibility with the rad tech organization. Through that organization's influence with the O&R divisions, Mei had little credibility with these divisions either (although some among them always respected a PhD). Also, there was a structural problem that undermined cooperation: the rad tech organization (RSS) and the rad (ALARA) engineers (AEG) were separate up to the division director

level, with no formal matrix relationships between them. It has never been clear to me whether or not Sims realized that these handicaps existed when he decided on the details of the reorganization, and if he did, whether he hoped it would all work out or he didn't care if it did.

Money and Efficiency Issues

When the incompetent secretary left at last (unbelievably, via promotion), we had a series of temps until the secretary position became RSC head Mlekodaj's secretary. The new person served the entire section as far as time tracking and other administrative work was concerned and she was in charge of ALARA committee minutes, but we AEG people did most of our other word-processing, copying, and related tasks ourselves and thus lost a measure of clerical support. The "Database Queen" had never been replaced on a permanent basis and now Randy Gorman of the dosimetry and records section was designated as a support person matrixed to Mlekodaj to provide bar charts of doses and other data representations. This meant that Mlekodaj and selected staff (but not anyone in AEG, it seemed) would track and trend doses and other radiological/ALARA indicators, thus taking this work out of our scope. Gheesling retired in late 1994, but no one was hired to fill his spot. We were told that the spot was on hold, with the vacant position being shown on our organization chart. The vague implication was that the position would be filled in, say, the next fiscal year when the budget eased up; I believe, from things that our managers said, that it was actually still a funded position, but the money was used on other things, as I note below. After a couple of years, they finally stopped showing the position on the org chart.

Some time after Butler retired, Walter Ohnesorge, a group leader and professional HP under Butler, also retired. Both of them, from shortly after retirement until perhaps late 1999 or early 2000, consulted for the rad protection organization one or two days a week each. Butler was said by Mlekodaj and Mei to be doing ALARA work of the sort done by the rad engineers -- one job he was assigned to do was to look at ORNL's highest-dose facility, REDC, and recommend dose-reduction measures -- but he reported directly to Mlekodaj, not to Mei. Ohnesorge did a variety of jobs for RSC, mostly of the same type as AEG did, but he too mostly seemed to be working directly for Mlekodaj.

The money to support these consultants came from RSC, according to Mei, but a comment to me on one occasion implied strongly that their funding actually came from AEG's budget. I also had a sad little conversation once with Geber (who was on a more informative grapevine about finances than I was) about how some of the money for our unfilled and apparently still budgeted rad engineer (Gheesling's) position seemed to be going to these consultants and the rest seemed to be mysteriously directed to other things. Indeed, our whole budget seemed fishy to me. At our first AEG meeting on 1 February 1994, Mei and the AEG Source Control technicians related that a van had been bought out of the Source Control budget. But Sims allowed the Measurements Assessment Group (which had been part of the ES&H organization but which post-reorganization was in a division other than ORP) to have the van. Thus Source Control did not have the van or the budget money either. Mei and Source Control said that supposedly the MA Group had ordered them a truck as reimbursement, but they hadn't seen any sign of it either. Eventually they did get a vehicle, but only a long time later. Hence it seemed that rad protection management was already engaged in budget-shifting even though the fiscal year had months to go. At this first AEG meeting too, Mei asked us if we had any projects for graduate students. Somehow ORNL's budget -- or was it ORP's? -- had money to pay for one or more graduate students to come and work during the summer. But the money for their relatively unskilled labor could have been more usefully directed toward hiring a permanent person, I thought.

Similarly, while I enjoyed seeing the pleasant Butler and the thoughtful Ohnesorge every week, it would have been better for continuity and for flexibility of assignments within AEG to have had the money they were paid used for a permanent person within AEG, or at least to have one temporary person doing work directly assigned by Mei. Butler and Ohnesorge were smart (and Ohnesorge was a certified health physicist) and, not being privy to all the details, I cannot say that their work was not worthwhile. But their work did not seem to take AEG needs as a priority. E.g., twice I was asked to

give Ohnesorge some work; in each case, I devoted significant time explaining the assignment to him. The first time he was able to finish most of the assignment but did not have time to settle the remaining questions; the second time he was not able to finish the assignment after spending several days on it. Each time Mei told me that he was pulled off to work on something for Mlekodaj. So his time on the two assignments was entirely wasted because no conclusion was reached. If this work had been done by an AEG person, both assignments would have been finished off completely and less time would have been spent explaining.

From the start, there was a discussion of the budget at most AEG meetings. My notes of an AEG meeting on 11 August 1994 show that the AEG's budget from overhead was "a little less than $800K"; with Hamley and Gregory included as a sort of adjunct group, it was said to be about $900K, although they actually reported to Mlekodaj. Mei noted that this included an unfilled half-time position for "tracking and trending" doses, etc.. I believe that the half-time money was either reallocated for other things or went as partial support to Gorman, who as noted, was in another section. In either case, we never got a dedicated person who was formally in our group. (This is not to criticize Gorman or his work -- he is not only very competent, but also a truly nice guy.)

I did not understand the reference to including Hamley and Gregory at the time. From later information, it seemed that the $900K was insufficient to support 9 people (Mei's number) plus a tenth person half-time to track and trend, because the estimate of how much it cost to support a person at the time was $100-140K, depending on whom you asked. It is true that there was some money coming in from outside AEG. For example, I had some of my time paid for by the RORC budget; this was overhead money, but not AEG or ORP overhead money. Most of other AEG members also had some side function that allowed for chargeout in similar ways. Still, there was a decided shortfall, according to Mei. I conjecture that there was an expectation that some money would also come in by direct chargeout of our core work or by increased side work, although this was not explicitly stated.

Gheesling and I, under Setaro, had been termed "ALARA engineers" and Geber and Utrera, under Butler, were termed "radiological engineers". But with all four under Mei, we were viewed as performing essentially the same core work; in fact, my notes of the August 1994 meeting show that she referred to our functions as "ALARA/radiological functions". But as I later discovered, Gheesling and I continued to be paid out of a subpot (of the AEG pot) called "ALARA Engineering" and Geber and Utrera out of a subpot called "Radiological Engineering". I protested this to Mei, on the grounds that it was not representative of the situation as presented to us (i.e., that we were equal in function and status), but she told me that "they" (the higher-ups) wanted it that way and it didn't matter anyway. I thought that it did matter; I was still concerned because of things that had happened in the past with shifting of money from one section to the other. For legal reasons, this was not supposed to happen, but it had -- I remember Setaro and several other managers commenting unhappily on it. The more subpots there were and the more obscure their names, I thought, the easier it was to justify the shifting of money with some hokey explanation of what work was being done for the transferred-from by the transferred-to. It also allowed the more overhead-supported people to subsidize the less overhead-supported. As one of those who at this time was almost completely supported by overhead, I realized that this could benefit me, but I was always in favor of letting the real costs of work be evident. Besides, the transfers always seemed to be out of whatever group I was in and into some other group.

My September 1994 notes included Mlekodaj's telling us that that he told the ORNL [Executive] Operating Committee "No tickee, no washee" -- i.e., there was apparently some kind of proposal to have his section charge out more and he was warning them that in that case, we would always have to have a charge number before we could do any work. Despite the budget issues, however, there always seemed to be time and money for people to take courses such as "The Seven Habits of Highly Effective People". In ALARA terms (i.e., "reasonably"), I though our time was better spent in doing our work.

The inefficiency of dispersed locations seemed unimportant to ORNL management. At our first AEG meeting, it was noted that Source Control would have to stay in the offices they were in, blocks away from the rest of us. Eventually they moved, but to a trailer still several blocks away. Geber and Utrera were also in another building at first. When Hunt came to head up RSS, Hunt got Mlekodaj's office and Mlekodaj finally moved to Setaro's old office. To help us stay connected, Mei suggested that we have a quarterly section meeting, but Mlekodaj demurred: he didn't want to have to have yet another regularly scheduled meeting to attend, even of his own staff. He said that it would be a "waste of time" to schedule a meeting without a specific reason for it, i.e., just getting together to discuss work and problems was not worthwhile. So in the first several years we had perhaps one section staff meeting.

Line Management Responsibility

In a memo to Sims, Steve Hamley gave his ideas on how to improve rad protection at ORNL. Hamley, with 17 years as a rad tech at ORNL, had just finished his bachelor's degree (or would do so soon after this) and as I noted would in future years specialize in the conduct of rad protection operations; he always had an interest, beyond that of the average tech, in how the program might best operate. In the memo he stated that "the basis of our function at ORNL, that line [O&R] organizations are responsible for radiation protection, is not as valid as it once was....Without doubt, line organizations must be responsible for implementation of the radiological protection program, but the ability of our line organizations to evaluate the need for and apply state-of-the-art radiological controls has to be questioned in light of some recent incident evaluations". He noted that society and DOE expected not just the public but also workers to be protected. His proposals for improvement included clarification of how rad protection and line management interacted and "back to basics" efforts such as more conscientious adherence to requirements for frisking, with better supervisory oversight of compliance. He listed items that were precursors to high-exposure events, as given by the Institute of Nuclear Power Operations (a nuclear power industry think tank), including inadequate work controls, insufficiently trained rad techs, line supervisors not being accountable, and (overall) management not being involved in rad protection.

This memo was notable not only for Hamley's views from the rad protection "trenches", but also for the idea that line management was responsible for implementation of the rad protection program. This was touted as a new or newly prominent idea under the Integrated Safety Management System (about which I will say more later), but it appeared in DOE documents as early as or earlier than the 1992 DOE Rad Con Manual. From Hamley's memo and other sources it is clear that this idea was already a management principle in the DOE world. (The reader may want to compare Hamley's statements above about line management judgment with his subsequent statements about customer service, which I will quote later.)

BNL ALARA Center Visit and Y-12's Rad Engineering Organization, 1993

While the rad tech organization did not seem to be very interested in what their counterparts at other sites were doing, we rad engineers in the ALARA Program were eager to learn what other sites were doing in operational health physics and especially in rad engineering. In 1993, Bruce Dionne of the ALARA Center at Brookhaven National Laboratory and John Connelly of DOE-Washington came to visit ORNL and Y-12 as part of their tour of five or six DOE sites to benchmark the status of rad engineering in the DOE complex. Dionne and I think also Connelly had worked at nuclear power plants, where rad engineers, ALARA coordinators, and like-titled rad protection specialists were commonly encountered. Also, much of the ALARA Center's guidance was directed at engineered controls. So Dionne had proposed, and DOE had approved, a study to see to what degree rad engineers were being used in the DOE complex and what their duties would typically be. Dionne and Connelly also sat in on our ALARA course for engineers.

I had known Dionne for about two years at this point and respected his knowledge and his energetic pursuit of radiological betterment. With Dionne, it wasn't just a matter of dose reduction (ALARA),

but of increased efficiency and reliability of work as well. I found his can-do take on health physics inspiring. After the tour of sites was over, Dionne told me that he thought the best rad engineering group was at Idaho National Engineering Laboratory (INEL, later called INEEL). However, he remarked, with a change of contractors there, that group was being broken up and some left or were transferred elsewhere. This did not bode well for rad protection at INEL, he thought. (Note that the Brookhaven ALARA Center later lost so much funding that it was dissolved. Dionne then went to a Brookhaven environmental cleanup group to provide rad support.)

I believe that it was as part of this visit that AEG attended a briefing given by Y-12 rad engineering people on how they were organized and what they did. I will go into some detail about their organization because of the differences between their operations and AEG's. At this time, ORNL had perhaps half the people that Y-12 did but certainly did not do only half of the significant rad work that Y-12 did. Besides, at ORNL there was much more possibility for significant external and internal dose, considering ORNL's work with transuranics and considering that Y-12's work was virtually all with uranium and its daughters. ORNL had a much higher collective dose and a much higher maximum individual dose (e.g., one year, the maximum individual whole-body dose was 400 mrem for Y-12, versus about 1000 mrem for ORNL). Hunt was shown on the Y-12 organization chart, as he was still the head of Y-12 rad protection then. Answering directly to him was the head of the Y-12 Radiological Engineering Section (RES), who in turn had answering to him two rad engineering groups, each with five rad engineers; one clerical assistant; and one quality assurance and compliance specialist. Even omitting the clerical assistant, there were 12 people in all, counting the RES head, compared to 4.5 people in AEG (the .5 was AEG Leader Mei, the other half of whose time was spent supervising the Source Control group, doing DOE dosimetry audits at other sites, etc.). Of the 10 rad engineers in the two Y-12 groups, four had M.S. degrees and 4 more were currently doing course work leading to a master's degree; one had the NRRPT (rad tech) certification and two were certified health physicists. Their responsibilities included design reviews of engineering projects, health physics oversight of construction projects, and health physics technical support to operations divisions and to the rest of the rad protection organization.

Y-12's RES received notifications of all engineering projects and commented if necessary; comments were peer-reviewed by another rad engineer. Their average response time for this comment activity was one week. They also served on readiness review teams for facilities and processes. They were sent all operating procedures and reviewed them if necessary; if he deemed it appropriate, the reviewing rad engineer would conduct a procedure walk-through with the writer-operator, do an evaluation of the need for air sampling, etc. This review too was peer-reviewed by another rad engineer. Based on the review, an approval signature from an ES&H representative went on the procedure. The rad engineers provided radiological-related language for bid specifications. They did appraisals, e.g., of decontamination operations, against DOE and plant requirements and against "best" and "accepted" industry practices. They were represented on various committees: e.g., a rad engineer served on the Waste Handling and Radioactive Contamination Committee. They provided technical support to the rest of the rad protection organization in areas such as writing technical basis documents, evaluating continuous air monitoring, doing incident investigations and surveillances, revising the RWP program, and implementing the Rad Con Manual (for which they were the designated technical experts). Technical basis documents included those for workplace air monitoring, respirator selection, and workplace surveys of removable surface contamination. They handled the pilot project for a continuous air monitoring study and wrote the report; after the technical basis was established, they turned over day-to-day coverage to the area monitoring functional group. In doing investigations, e.g., regarding potential intakes, they did root-causing and formulated corrective action recommendations. They trained the trainers who taught line supervisors and others how to write RWPs.

The important points about the Y-12 rad engineering organization are thus that they, rather than the rad tech organization, provided the technical expertise in the rad protection organization; they had a good deal of review authority in engineering design and modifications and in operational

procedural content; and they were the think tank for the rad protection organization, notably as regards compliance issues. This organization also appeared to me, from subsequent conversations with other sites, to be typical of what the DOE world was going to in terms of putting the resolution of technical questions in the hands of designated rad engineers or senior health physicists, not in the hands of people in the field whose main duties were supervising or performing day-to-day technician activities. We in AEG could only sigh at hearing what our Y-12 counterparts were doing -- as we will see in this and subsequent chapters, this was not what ORNL was going to. The interested reader may wish to compare the recommendations for ORNL by the 1989 appraisal team mentioned above to what Y-12 managed to get to in 1993.

Corporate Centralization Problems

When I came to ORNL in 1989, MMES managed ORNL, Y-12, K-25, and the uranium enrichment sites in Portsmouth, Ohio and Paducah, Kentucky. Although each site had its own safety organization, the five-site centralized safety coordination and management organization (which was part of what I refer to as MMES Central) dictated policy and often procedural requirements for all the sites. It was recognized that there were problems with this five-site centralization, partly due to geography and partly to the different hazards at the different sites. It was clearly more efficient to have a separate safety organization at each site but to coordinate among the sites the approach taken to implementation of DOE Orders and, to some extent, the methods used. Still, this often led to the subjugation of the interests of one site to the interests of all the sites. This was most burdensome to ORNL because the hazards and types of work were truly different: the principal problem at the other sites was uranium isotopes and their radioactive daughters, but ORNL was using or had used "every isotope from A to Z", as we used to say. Also, management seemed to view the weapons production plant, Y-12, and its problems as the most important and their preferences as the default method of doing things.

Another problem with the centralization was that the five-site central bureaucracy was very politicized. It seemed to me that all levels of these bureaucrats were obsessively concerned with maintaining their positions and their groups' status and influence within MMES. I also found it very striking how much attention they paid to what local and Washington DOE bureaucrats would think about this or that contractor action, instead of to what would be most appropriate from a personnel protection point of view. An illuminating example of this was a series of meetings I attended in 1993 on setting ES&H performance indicators for the five sites. Swanks needed a delegate to attend but Setaro was booked, so I was sent instead. All I had to go on was a handout sent to Swanks, but the purpose of the meetings seemed clear: at the first meetings the attendees would discuss how to set useful and representative indicators, each safety discipline and site would come up with proposed indicators between meetings, and then the indicators would be discussed and selected during the subsequent meetings.

When I got there, I found that although I thought I was attending the kickoff meeting, there seemed to have been a previous meeting that a few of the several dozen people present had attended. The meeting leaders were among them, so the meeting started with certain assumptions seemingly already agreed to; those of us who were new were thus at a disadvantage in following the discussion. The meeting seemed rather unfocussed compared to the project, facility, and staff meetings I was used to at ORNL and at my former job in the power plant world. But at some point, the discussion turned pointedly to an aspect that seemed to have been mulled over at length in the previous meeting: what performance indicators might be acceptable to Hazel O'Leary, the Secretary of Energy. I listened in amazement as these people, all apparently degreed professionals, speculated on what indicators O'Leary might wish to see -- personally. I found it unbelievable that the Secretary of Energy would herself inspect or even care about the performance indicators chosen by each site, but that was explicit in their speculations about her approval of the indicators. In particular, one meeting leader remarked from time to time that a DOE-Washington functionary had told them that this or that sort of indicator was favored by O'Leary or that she liked to see tracking of this or that sort.

As the discussion continued, proposals were made. Again, these seemed to have been discussed by some people previously and the meeting leaders treated these pretty much as an agreed-on set, needing only refinement. I was amazed again as I saw what sorts of indicators they were. In rad protection, as in other safety disciplines, there is a set of standard indicators that most companies or sites use and each company or site then adds some indicators that target specific aspects of its operations that are desirable to track. Most of the indicators usually used are related to dose, contamination, and radwaste. For example, you might track how many people got more than 200 mrem of dose in a calendar quarter or a year, how many square feet of (sign-)posted contaminated areas there were, how many cubic feet of radioactive solid waste had been generated. You might want to track bellwether indicators such as how many people were found to be contaminated when they were checked while exiting a contaminated area, since that helps to show whether people are using good contamination control techniques or not.

But in this first meeting, these people were discussing touchy-feely indicators. For example, one proposed indicator was how many safety suggestions were submitted. Certainly a site should keep track of safety suggestions, but tracking them as though the number submitted was per se significant seemed wacky. True, having no suggestions at all might indicate a problem with a safety program since that could mean that workers thought that their suggestions were unwelcome or there was no clear mechanism by which to submit suggestions. But if suggestions were being submitted, then whether there were two per month or six per month or fourteen per month would seem to be a function of the work at the site and how routine or novel it was. This could be tracked or evaluated by a different method than a significant performance indicator, if it needed to be tracked at all. So why the number of suggestions workers were submitting should be a performance indicator was not clear.

There were also indicators proposed that made no sense in terms of how they were phrased, even though the core idea might have been sound. For example, there were "Numbers of less toxic materials substituted for more toxic" and "Number of engineering controls implemented to reduce use of personal protective equipment". I pointed out that the numbers alone might not be meaningful phrased this way and that without guidance, it would be hard to tally the substitutions and controls consistently. (Does the installation of a double HEPA filter count as one or two?) However, as my notes indicate, my concerns were overridden again and again. The meeting leaders did eliminate "Increase/decrease in number of requests for safety and health evaluations (i.e., decrease in requests hopefully indicated employee involvement in evaluation and correcting) [sic]". But there was also a suggestion that some quality inspections of company vehicles be turned over to the employees using the vehicles -- "currently most inspections are conducted by safety and health -- need more front-line employees involved". I thought it was odd to propose to turn official safety inspections over to "front-line" employees, who weren't trained to do the inspections, who would not be doing them on a frequent basis and thus would not accumulate much experience in doing them, and who might pass unsafe vehicles in the interest of keeping operations going.

I stated that as regards rad protection, the standard indicators (such as the examples I gave above) should be included. I was assured by one of the MMES Central people that those would be included "too". But they did not want to take time to discuss any site- and discipline-specific indicators; they seemed to want to concentrate on psyching out O'Leary. The number of "soft" indicators proposed appeared to me to exceed the number of "hard" or substantive standard indicators proposed -- meaning that as much effort would be made to track the soft indicators as the hard ones. When I related all this to Setaro after the meeting, he just shook his head. He understood the MMES Central staff mentality because he had attended various types of meetings with these people, both as ALARA Program manager and as a substitute when Swanks could not attend. He agreed when I stated that these people, who were supposedly in charge of ES&H, were not producing representative, effective indicators of actual safety performance but were focussing instead on how to please and impress the Secretary of Energy by coming up with exquisitely people-sensitive indicators. I (and I believe some of the other folks who were not among the movers and shakers at these meetings) was never

presented with a final proposed list of indicators for comment, much less approval. I do not know whether ORNL subsequently tracked any of the soft indicators. I suspect that because of resource problems, only the hard indicators could be tracked effectively anyway.

One person at these meetings seemed to me to be a rather accomplished yes-woman, even beyond the norm. Although she did not speak at length at any time, she was called on several times at each meeting by one or two of the leaders, apparently because she was on the "Exposure Prevention Subcommittee" that had produced many of the suggestions. I found it striking that her utterances seemed to be so devoid of content compared to the attention paid her. She was subsequently promoted to a high safety management position; rumor had it at the time that it was one of those concessions to DOE's demands to put more women and minorities in management positions and that she was promoted over multiple people with better qualifications. This was confirmed after my layoff by some fellow layoffees who used to work for her. I mention her here because she typified the sort of substance-lite, go-along person who seemed to do well in the politicized five-site management environment and because she enlightened me later on as to ORNL management philosophy.

I have a late 1993 memo that I wrote to Sims in which I asked about a draft of the ORNL ES&H Plan that he had sent me for information, marked with his comments. The section on ES&H goals seemed to have been written by a Martian: the wording was in some sort of business-ese and did not sound as if the author understood rad protection concepts. Sims apparently was not asked for input on the Plan and as far as I could find out, neither was any other ORNL rad protection person. The main rad protection goal was arbitrary: the calendar year 1993 administrative annual limit ("goal") of 750 mrem was to be reduced by 50 mrem a year for 5 years. I asked him why he proposed to put a Band-Aid on this plan by proposing mild rewrites in his comments, instead of firmly advising against it as it was -- I asked him, "Aren't you Mr. Rad Protection at ORNL?", i.e., why wouldn't they take his authoritative word for it?

A rationale for the continually reduced ALARA goal was given in this draft thus: "Decreasing the administrative limit on an individual's dose drives the [O&R] Division Director to improve [sic] ALARA, but at the same time gives him the flexibility to complete the Division's work". Sims pointed out in his comments that five or six divisions accounted for 90% of ORNL dose and that they could "excel in ALARA" and still exceed the ORNL goals. He proposed that such divisions should be allowed to set "challenging" goals based on their workloads, citing as an example the radwaste division (whose work in any given year might or might not include a dose-intensive waste solidification campaign). I again pointed out to Sims that he was right -- so, again, why propose a Band-Aid, as he appeared to do in his add-on rewording? I also pointed out that with only an individual limit and no collective limit, there would be a temptation just to use more people to stay under the goal, rather than improve radiological controls. I observed, "The whole point of ALARA in the '90s is that we are to put dose reduction on as rational, objective, and quantitatively sound a basis as possible -- and [yet] look what we at ORNL are coming up with". I suspected that the point of the five-year reduction was that it would look good to DOE to see a proposed continuous decrease, however impractical and in fact anti-ALARA it was.

When Lockheed and Martin Marietta merged in 1995, the managing contractor name changed from MMES to Lockheed Martin Energy Systems (LMES). In time, Portsmouth and Paducah were detached from LMES and run by a different company, but the centralized coordination of the three remaining LMES sites continued. Under the threat that the DOE contract to manage ORNL would be split off from the contract to manage Y-12 and K-25, the then-CEO of LMES tried to combine the three sites' safety and security organizations in an effort to “prove” that the operation of the three was too centralized to be disentangled. I will not go into all the actions taken to effect the combination, but suffice it to say that the entangling, and the eventual disentangling, were costly in terms of efficiency and effort. This contortion of the safety organizations to serve the corporate aim of keeping the contract rather than to increase the safety and efficiency of operations was very discouraging to safety personnel. It was clear that top corporate management, despite its

protestations about its commitment to safety, was willing to overrule all informed opposition -- i.e., the middle and upper safety managers at each site -- who counseled against the artificial and inefficient combination.

But it was all in vain: in about 1997 DOE would eventually bid the Y-12 and ORNL contracts separately and make the K-25 site into an industrial park with piecework cleanup projects. With a separate contract for ORNL, the O&R divisions that had yearned for years for attention to their individual problems would finally get it.

Work Smart Standards

In the mid-1990's, DOE adopted the "Work Smart" standards (WSS) for safety and health. The original name of these standards was "Necessary and Sufficient", a term from logic and mathematics implying that you had all you needed and no more than you needed. But according to DOE people I talked to, this was not a sexy enough term for DOE Secretary O'Leary, so she had it changed to "Work Smart" even though various documents had already been issued using the original term. The basic WSS idea was that instead of trying to apply all of the DOE Orders (regulations that are not, strictly speaking, laws), each contractor would examine them, plus industry standards, and choose which ones would apply to its operations. The set of documents chosen was supposed to include all those necessary to reduce the risks to acceptable levels and, taken together, was supposed to be adequate (sufficient) to cover all site activities. In addition, the contractor could have different sets for different facilities or projects, or could have one central set for a site and add-on subsets for facilities or projects.

This would have been a useful idea, consistent with the commonsense idea known as the graded approach, except for one problem that the graded approach also has: its subjectivity. The WSS approach can work if the DOE folks who review and approve a site's (or division's or facility's) WSS set know what they are doing -- i.e., if they are familiar with the work and its associated hazards and they know the regulations, industry standards, etc. well enough to determine whether the choice of regulations, etc., is indeed sufficient to cover all the hazards and types of work and is indeed adequate to reduce the risks acceptably. However, in my experience of the process this was not the case. I looked at some other DOE sites' descriptions (on the Web) of how they arrived at their WSS sets and I concluded that ORNL did not do the systematic, methodical evaluation that these other sites seemed to have done. Like the other sites, ORNL formed one committee to produce its sitewide set and other committees to produce subsets for facilities and projects. But whereas one could see for other sites extensive documentation of the rationale behind their selections, or at least detailed checklists and evaluation forms, ORNL's documentation was sketchy and often vague. The local DOE office had to bless the selection, of course, and one would have assumed that they could have asked for and gotten documentation to the same degree of detail as other DOE offices had gotten from the sites they oversaw. But the local office did not do so.

One prominent DOE Order that was omitted in part from ORNL's set was 5480.19, "Conduct of Operations". This was supposedly one of the Orders that had applicability at all sites. Yet local DOE allowed ORNL to leave large pieces of this Order out of its general WSS set and all of the subsets. I do not believe this was an oversight on DOE's part since it was stated explicitly in ORNL's WSS writeup that the pieces were being left out. I was told that long afterward, DOE-Washington noticed the omission and made ORNL put the Order back in in its entirety.

The O&R division WSS selection process that I was most familiar with, that of the Research Reactors Division (RRD), seemed particularly flawed, most importantly because they did not seem to have had it reviewed by many people outside their own organization. For example, they did not have RORC (the independent internal reactor review committee) review their set, even though RORC was intimately familiar with RRD's reactor safety and operational practices, reviewed RRD's other safety documents, and arguably was required to review such documents by the terms of its charter. Also, RRD had only their local rad tech complex leader, Roger Davis, review the set for rad protection

considerations. I was concerned about this, particularly since I knew Davis was not familiar with some of the rad protection procedures, such as the design review one, or with the draft HFIR safety analysis report. When I asked him about his review, he was so vague about exactly when he had seen and reviewed the document and what it contained that I was convinced that he either had not seen it at all or had not read it.

As is suggested by ORNL's handling of the WSS set production, safety coverage at ORNL became increasingly fractured, with each division and even each project or facility trying to get special rules or exemptions to rules made, even where there was no real difference between them and other divisions or projects or facilities with respect to a particular rule. This inhibited implementation of site-wide requirements. For example, RRD had a years-old practice of requiring internal RRD approval of any new or revised site-wide rad protection procedure before RRD would begin to use the procedure. This was despite the fact that each such procedure had already gone through a site-wide review process (including review and comments submitted by RRD) before it was revised and each had already been approved for use by the appropriate ORNL central procedures committee, which had a member from RRD. Thus a commitment by ORNL to DOE that procedures issued under such-and-such a revision would be in use by a certain date could be undermined by RRD, which would take up to a month to do its own internal review -- or, in reality, its re-review.

The ORP Internal Assessment Based on Malcolm Baldrige Criteria

In July 1994, an "Office of Radiation Protection Internal Assessment Based on Malcolm Baldrige Criteria" was issued. I have only a portion of this report, but what I have is illuminating in terms of what it indicates about ORP management thinking and the ORP budget. The pages I have include the information in the table below. (Note that I began work at ORNL in FY90, i.e., November 1989).

Total ORP Expenditures and Staff vs Overhead Expenditures and Staff (in millions of dollars)

	FY90	FY91	FY92	FY93	FY94
Total expenditures	6.0	9.8	9.8	11.7	12.0
Overhead expenditures	3.8	5.7	4.9	4.4	4.4
Dosimetry and records only	$3.2	$3.3	$3.3	$2.9	$2.8
Total staff	105	138	158	180	185
Overhead staff	56	71	66	60	60
Support from overhead	63%	57%	50%	38%	37%
Number of dosimeters issued	56,000	69,000	68,000	69,000	70,000

The report pointed out that although the budget had been relatively stable since early 1993, there was a decreasing percent of overhead funds "required by ORP". This was because of ORNL's efforts at what was later termed "re-engineering", with an emphasis on reducing the overhead. In many companies and organizations, putting the safety department budget mostly or completely on overhead is regarded as appropriate. However, at ORNL and similar large multifunction sites, not all facilities require the same level of safety support. So as I noted earlier, it was regarded as appropriate for those facilities or entities using safety services to bear most of the expense of them by having a significant level of charging out by the safety people; at ORNL, not all divisions do rad work and those who do it don't do it to the same degree, so the rad protection budget was viewed as appropriately charged out to a large extent.

In the time period covered in this chapter, 1989 through 1994, services provided by the dosimetry and records section (RDRS) were not charged out, according to the report. Everybody working at the

ORNL main site and at the various satellite sites (reactor, waste areas, and the like) wore a dosimeter whether he was a rad worker or not. This included accountants, secretaries, cafeteria workers, and others who never had occasion to enter a radiologically controlled area. This was done for two reasons. First, the entire main site was regarded as a radiologically controlled area and was so posted, even though there was not any radiological hazard in most of it. Second, in case a worker stricken with cancer sued the company, alleging that his dose caused the cancer, there would be an actual dose measurement available from the dosimeter. Thus having everybody wear a dosimeter helped protect ORNL (or rather LMES) from nuisance lawsuits by people who could not possibly have received enough dose to affect their chances of contracting cancer. As RDRS head Thein pointed out and as shown in the table above, the cost of having the dosimetry staff, readout equipment, and dosimeters for rad workers constituted most of the cost of having dosimetry, so the cost of adding dosimeters for nonrad workers was a relatively small increment even though most workers were nonrad workers. The case for having bioassay services (urinalyses, whole-body counts, etc.) on overhead would be murkier, since virtually all nonrad workers and even most rad workers never needed a bioassay. However, these services were still on overhead, I believe. The same was true also, I think, of the nondosimetry records services, such as the radiation work permit records.

The surveillance section (RSS) could readily charge out rad techs' time because they were almost all assigned to specific facilities and specific tasks. The rad tech supervisors -- the complex leaders and the group leaders who supervised them -- were also mostly supported by an extra charge on the time of the rad techs, the idea being that when you were buying the time of the rad tech, you were also buying part of the supervisory services needed to "run" him. This was a practical solution to the problem of supporting the supervisors. But the extra charge was the overhead that supported the supervision. Thus although the surveillance section liked to say that they were supported by chargeout, in effect some of them were supported by an overhead and not by a direct charge for their specific labor.

The Radiological Controls Section (RCS) was the most problematic in terms of charging out. First, it was not easy to persuade the divisions that having a rad protection specialist on the team doing a design or planning an operation was necessary even though DOE had said that it very often was (e.g., in the draft 10 CFR 835 implementation guides issued in about 1995) and even though this was standard at most other sites. In part, this arose from "anybody can do ALARA" thinking; in part, from the idea that design or planning could be checked by the rad specialist retrospectively, or at least near the end of the design or planning; and in part, from the idea that the local rad tech or rad tech supervisor's input was sufficient in most cases. Second, in terms of operations in existing facilities, even though DOE had said that these should be reviewed periodically for ALARA reasons, the operations people did not see any need for a rad engineer to look over their ongoing operations. Since there was resistance to having it done, there was also resistance to paying for it to be done.

Third, after the two rad engineers (Geber and Utrera) moved out of RSS and into RCS, there developed within RSS a group of people who more than ever identified strongly with the operational groups they worked in and were advocates of these groups' interests against "meddling" by independent elements. These people apparently began to disparage RCS to their local operational management, which we in RCS began to hear about from certain people in RSS who were friendly to us. They told us that the anti-RCS group contended that we were trying to horn in where we didn't belong, that we were trying to provide services that were not needed or that could be or already were being more cheaply provided by RSS. We began to hear these same criticisms from O&R people, usually using the same arguments and even the same exact words. Thus we knew that some people in RSS were trying to undermine the rationale for our existence, which was, I reiterate, the provision of professional-level radiological analyses and evaluations that could not be provided by non-rad-protection specialists on the one hand or by nonprofessional or non-engineering-oriented rad protection specialists on the other hand (i.e., rad techs and their supervisors). This campaign made it increasingly difficult for us over the years, since pressure mounted on all sections to (1) move from overhead funding to charging out for all services and (2) ensure that the divisions "purchased" only

those ORP services that were absolutely required by procedure and were based only on DOE Orders or rules and not on mere "good practices".

The Baldrige assessment report also stated that the ES&H organization contained 393 people and its budget accounted for 12.3% of the FY 94 ORNL overhead budget, i.e., $21,000,000 out of $171,000,000. ORP was the largest group in the ES&H organization, but received "a relatively small amount of funding from overhead", as shown in the table below. (Descriptions are followed by office name abbreviations.)

ES&H Staff and Overhead Funding, FY 94

Office	Staff Members	Overhead Funding (millions of dollars)	Overhead Per Staffer
Nuclear Safety (ONS)	41	2.5	$61,000
Industrial Safety & Industrial Hygiene (OSHP)	112	7.2	$64,300
Environmental (OEP)	87	6.9	$79,300
Rad Protection (ORP)	153	4.4	$28,800

This assessment report was also one of the earliest ORP documents in which the idea of "customers" was used. However, because the Malcolm Baldrige criteria used are more appropriate for production facilities and for groups providing optional services than for groups providing required services or compliance oversight, the report author had some trouble reconciling the wording of the criteria with ORP's circumstances. For example, the assessment stated that "radiological workers" are ORP's main customer, when in fact ORP's customers were always viewed as being the O&R people (specifically the O&R managers and staff) by both the O&R people and ORP management.

The report noted that since RSS personnel were assigned to a given complex, they "are able to become familiar with the particular customer's operation....[and] more specialized with [sic] the area in which they are responsible". This was said to "help develop relationships (i.e., mutual respect, trust) between the RSS personnel and their customers since they work together on a regular basis". Further, "because RSS personnel work in and are responsible for a given complex, they are available to the customers in that complex at all times and provide the interface between the customer and ORP leadership". Finally, the report noted that there were biweekly meetings between the approximately 15 complex and group leaders and the RSS head, which provided "a system for prompt resolution of complaints". (The reader will recall that Mlekodaj refused to have RCS staff meetings even quarterly.)

With respect to "commitment to customers", the report noted that "corrective actions are used to satisfy customers when services are found to be lacking". This implied a formal resolution process, but there was no indication that there actually was one. The report noted that ORP had no competitors in providing its services and that comparisons to other sites could be difficult due to variations in organization and the level of service necessary (such as in dosimetry). But customer satisfaction was nevertheless said to exist on the basis of "Customer Satisfaction Surveys" and letters of appreciation.

Even granted that the focus of the Malcolm Baldrige criteria is on customer service, this report was still notable for what it revealed about the thinking of ORP management. There were only a few statements about how well ORP supported compliance as a service to the Laboratory as a whole, to Laboratory management, and to DOE. But there were many repetitive statements about how well ORP (and especially RSS) provided customer service to O&R entities. The report noted approvingly

the advantage that the rad techs had of being constantly in contact with their customers, but did not address how the other two sections dealt with their necessarily more limited contact.

The report said that since "technical expertise and responsiveness" were key requirements for customer satisfaction, items related to employee qualifications and activities were tracked. Listed were "professional certifications, degrees attained, education underway, committees supported, publications", etc. However, how these would make the customers happy was not discussed specifically, as the way that the assignment of RSS personnel to customer facilities was. For example, there was no reference to any advantage provided by having a person with a degree assigned to review a design or operation, as opposed to, say, a rad tech without a degree. Also, the report stated this: "ORP organizational capabilities are addressed through the use of a highly qualified technical staff. Many of the professionals within the division are technical experts in their field and have advanced degrees and professional certifications". However, there was again no specific tie-in of organizational capabilities and advanced qualifications with, e.g., increased effectiveness or efficiency. Thus the advantages of advanced qualifications were left implicit and without reference to actual work activities or assignments.

Referring to ALARA, the report said that "Technological and societal risks are addressed….via reducing the ALARA administrative dose goals" and that "a goal of ORP is to reduce ALARA administrative dose goals". I doubted that this represented the opinion of the ALARA Program Manager (Mlekodaj) or either of the ORNL ALARA committees because the administrative dose limit ("goal") was set on the basis of work contemplated and the practicality of controls, not on continual reduction of the limit. So the report statement was ALARA nonsense, to me. A section on management of "process quality" stated this: "Since keeping radiation exposures within limits and ALARA is a function that must be performed while work is in progress, many of ORP's functions support the RSS which is the primary interface with the radiological workers who are ORP's main customers". This is again nonsense, e.g., because design and planning (which precede execution of operations) and postjob reviews (which follow an operation) are an important part of the ALARA process. This all represented a significant misunderstanding of the ALARA process on the part of the author. The report thus supported the idea that ALARA was something primarily done by rad techs, not the ALARA Program staff, rad engineers, etc.

As noted above, the Malcolm Baldrige criteria are not really suited for application to a compliance operation such as a safety organization. Although the author (who was in RDRS) obviously spent a lot of time trying to match ORP's operations and functions with the criteria, in the best Procrustean fashion, she nevertheless ran into several problems and made several errors of fact. One of these was regarding the status of the Director's Review Committees, on which, she said, ORP was "represented". That implied that there was a seat on each relevant committee for ORP or that there was an ORP member on each committee, neither of which was the case. There might or might not be an ORP representative on such a committee at any given time. Further, in my experience on RORC, there was no formal interaction between RORC and ORP. Thus the report's statement that "the Director's Review Committees provide a direct path to management that completes the set of checks-and-balances for radiological protection" was decidedly a non sequitur. The report also stated that the Director's Review Committees included "customer representatives", i.e., someone from a division whose operations were being reviewed. In the case of RORC, at least, that was spectacularly in error since RORC was supposed to be an independent review committee and thus could not have any member on it from the division reviewed, i.e., RRD. Also, RRD was not RORC's customer -- top Lab management was. I wrote the author a memo explaining these points, but she never replied to me.

ALARA Course for Design and Operations Engineers

One activity that I began in this period and of which I was proud was the production of an ALARA course for design and operations engineers, i.e., engineers who worked on designs and operations in facilities doing radiological work but were not safety specialists. The course was modeled on one used in the nuclear power plant world, but DOE regulations replaced NRC requirements and the facility-

specific design requirements appropriate to the varied world of DOE nuclear operations replaced the narrower power plant requirements. The content was from me, but its preparation was overseen by Emily Copenhaver of the ORNL Energy Division, with Scott Taylor of ORP assisting, and the arrangement into modules, etc, was provided by an Oak Ridge Associated Universities group.

In giving it for the first time in 1991, I partnered with Taylor, one of ORP's training people; he acted as the training specialist and principal lecturer and I acted as the technical expert and special topics lecturer. We taught the course by invitation at Princeton in 1991 and at Hanford in 1992. DOE too was interested in such a course and in 1992 its TRADE organization, an affiliation of training organizations, picked up and distributed this course around the DOE complex. TRADE gave Copenhaver, Taylor, and me an award for this course. Several years later, a committee of DOE contractor representatives, including me, revamped the course for use around the DOE complex. Each site was supposed to tailor it for their use, as of course I revised it repeatedly for ORNL. With Taylor or Geber, I gave this course periodically until I was laid off in 2000.

At first, we gave it for free -- the only cost to participants was their time. Setaro felt that this would increase participation and that giving it was a proper overhead activity of the ALARA Program. However, from about 1993 on, Mlekodaj and Mei said that we would have to charge for the course. I felt that this made it less likely that people would sign up for the course because the course was never required (despite the requirements of the Rad Con Manual). It was considered an "enrichment" course and thus a luxury. I then proposed that a modest fee would be appropriate to defray the costs of the training room (since we had to pay for the central Lockheed Martin training rooms, if we used those) and the costs of the binder of material given to the student. However, I did not think we should charge for our time. But I was turned down because the course was viewed by the allegedly cash-strapped ORP as a way of bringing in money. Naturally, when we began to charge, the substantial fee made it harder and harder to fill the class with even the minimum 12 students.

It was a problem finding adequate facilities in which to give the course. We had lecture modules interspersed with practical exercise modules; the students split up into groups of three or four people to do the exercises, which the students found to be the most interesting and valuable part of the course. However, for the exercises to be effective, the students needed to be seated in such a way that they could face forward for the lecture but then get together quickly to converse and do their drawings and calculations during the exercises. We solved this problem by having multiple tables set with the long axis parallel to the front of the room. When the time came for the students to break up into their groups, each pair sitting side by side at the front tables would turn their chairs around and face the pair behind them across the second table row, thus forming a quartet that had a writing surface between them. Obviously a meeting room with a single conference table would not do for this. Because ES&H and ORP did not have a training facility that could be set up like this, we always had to book space in other people's facilities. According to ORNL rules, when you reserved a room you were not supposed to be bumped except for an emergency. But on one occasion, I had reserved a room over a month ahead of time and I had sent out the memos telling the students where to go -- and then, a few days before the course, I was told by the "owner" division that they had just "forgotten" to reserve it for themselves for that date and we would have to go elsewhere. I protested, but to no avail. We found another place and notified the students, but it was tough. I was anxious every time about being kicked out, right up to the moment class started.

For students' use following the course, I wrote an ORNL manual for design operations and engineers. This was perpetually in draft, as I tried to find time to finish it off, including having it issued as an ORNL technical report as Setaro and I wanted it to be. A person who had taken the course in 1992 urged me to finish it on the grounds that it would be a very useful document for people in both the DOE and NRC worlds. In 1994 I received a nice memo from him asking me to send him a copy if I ever finished it; he wanted to be able to use it as a quotable document, I believe in consulting work. I had to report sadly that I had not finished it yet. Class after class and year after year went by and I

was never able to do the final editing and paperwork to get it issued, because it was not a priority of my management. To this day, it is still only a draft.

Getting Our Money Back

In 1994 I ordered a small table for use in my office (for spreading out drawings, etc.), but it never arrived. We were told by the vendor that it had been shipped; we checked with ORNL Receiving, who said they had delivered it. We asked everybody about it, but it had vanished. So we re-ordered it. Then suddenly the first table appeared: ORNL Receiving had "misplaced" it and then found it. We canceled the second order (which probably meant a cancellation charge). I could have assembled the table myself because it was in only two parts in its box, but that was against the rules of the union contract. So we called for a carpenter to assemble it.

ORNL Receiving was run by the Plant & Equipment Division (P&E), which also had the craftsmen, the laundry, the steam plant, the janitorial force, etc. Some segments of P&E were excellent. I always thought the laundry workers were helpful and diligent; the painters, when I encountered them, were similarly pleasant and productive; and virtually every janitor we had was likable and was on a first-name basis with most of the people he or she served. Many of the mechanical types, such as the millwrights, had a lot on the ball; for example, one who worked at HFIR was known to be clever and his advice was sought in planning jobs involving mechanical operations because he could anticipate potential difficulties and recommend the best way of doing a job. So I do want readers to note that there were a large number of excellent workers in P&E; the problem was not the work, but P&E's billing practices.

There was a fixed charge for something to come through Receiving and be delivered (possibly it was a fixed fraction of the price), but the carpenter's time charge was not determinable in advance. The planner/estimator could give you an estimate if you asked for one, but that did not necessarily bear any resemblance to what was actually charged since, I was told by a former P&E person, P&E had a policy of charging off its craft time on a moving basis. E.g., if a craftsman worked all eight hours (less breaks, of course), his eight paid hours were charged against the eight-ish hours worked. But if he worked only three hours, because nobody needed him the rest of the time, they had to pay him for eight hours anyway. So they charged all or most of the eight hours to whatever charge numbers they had for the three hours -- meaning that the three-hour customer(s) paid for the day of work. It took the carpenter about 15 minutes to open the box containing my table and to use his screwdriver to fasten the leg assembly to the tabletop. I know this because I was there the whole time. So I thought they would charge me for, say, one or one-and-a half-hours, counting transport from his shop. But they charged me for three hours. The craftsman's time included a surcharge for his division's overhead, which was reputedly high compared to other divisions. So three hours of a union carpenter's time plus the surcharge put the cost to assemble the table at over a hundred dollars -- even more than the cost of the table. This seemed ridiculous to me. It was one thing to round off a whole day when a person was working 4.5 days (so the charge would be for 5 days), but it was absurd to pay for more than three times what the job actually took.

Because it was outrageous and because of our tight finances, I called P&E. Over several weeks I tried to get the planner/estimator to give me a yes or no answer about the charge and about refunding some of our money. I then sent him a memo about it. After some weeks with no answer, I sent him another memo, with copy to his boss; after more weeks of no answer, I sent another memo, with copy to his boss's boss. After several months, a P&E supervisor finally got back to me and he and his manager talked it over with me. They ended up refunding an hour. So the table assembly still cost 2 hours of time for a 15-minute job, but I felt I had won a moral victory: I had gotten the charge closer to reality.

I had put my management on the distribution for my memos, so Sims and Mlekodaj knew what I was doing. Sims told me by memo near the end of the process that he thought I was wasting my time, but he didn't tell me not to do it and he made it clear that it was my choice. He certainly did not express

anger about it. Mlekodaj and Mei didn't tell me to drop it either. Sending the memos did not take a lot of time, since each essentially referred to the last and repeated the same information. I thought it was important to make the point to P&E that we could not afford these huge charges on our small budget, especially since we could not find out in advance how much we would be charged. I realize that some people might think I was quixotic in my pursuit of a refund, but I felt that my managers, in their repeated acceptance of highly variable and often wildly out-of-proportion charges, were torpedoing their own budget controls. This incident shows how skewed some of the budgetary processes at ORNL were and how my managers did not object to what might be (according to DOE regulations) illegal charges. Notably, this incident featured in my whistleblower hearing later on: what Sims did not forbid me to do at the time and did not sit down and talk with me about at the time, he later used as ammunition against me.

DOE and Money

Despite its professed desire to spend money wisely, DOE sometimes seemed to operate outside of the real world. For example, when I had been at ORNL less than a year, Setaro told me one midmorning that a DOE rep wanted some information on ORNL doses and related topics, in the form of a page of "bullets", by the end of the day because the rep needed it for a meeting the next morning. Setaro was busy and asked me to do it. So I put aside everything I had planned to do that day and started to dig out the information. Unfortunately, I had to request some of it from RDRS and they could not get it all by the end of the day. I got it first thing the next morning and faxed it to the DOE rep, hoping that he would still be able to use it. Despite all the time and effort it took us and despite his certainly having received it, I never received any acknowledgement from him. In later years, DOE would often act almost deferential to contractor personnel, but in these early years, a "Let them eat cake" attitude on the part of some DOE people seemed to be the norm.

Also, in 1990 or 1991, Setaro told me that local DOE's own budget was running significantly short. (I forget why that was, if indeed Setaro told me.) But DOE had to get it from somewhere, so they informed the Oak Ridge area sites that they needed to take back some money that had been budgeted for the sites. ORNL's share, according to Setaro, was about a million dollars. I was stunned by the magnitude of the takeback; it was so large an amount that it made a huge impact on already committed-to Lab projects. Besides that, if the budget for ORNL was approved in detail by Congress and DOE was (apparently informally) taking some back, then surely the takeback was in violation of the law. Perhaps not, but at a minimum it smacked of poor planning and callousness.

In 1994, DOE went off on a tangent on the strength of a single incident. A young subcontractor employee working for a project at, I think, Y-12, was driving a company truck on the Oak Ridge Reservation down the middle of a restricted road, with her seat belt unfastened and at a high rate of speed. As she topped a rise, she saw a car coming at her in the opposite direction and she veered back into her lane to avoid a collision. Her truck spun in the gravel and flipped over and she was flung out and killed.

A sensible safety person would say that an appropriate and meaningful response to this incident would be to use this as a lesson learned to instruct other workers; to provide increased security coverage of the back roads to discourage other drivers from using them as short cuts; and to penalize people who did not fasten their seat belts as required. This approach would have taken account of the fact that the subcontractor had violated at least four rules (seat belt, speed, staying in one's lane, and road access) and so was largely to blame for what happened to her, while at the same time it would seek to prevent others from repeating her mistakes. But DOE then ordered contractors with more than a certain number of employees to have 90+% of their employees take a defensive driving course by a specified date. So we all spent most of a day in such a course, apparently at contractor expense. This was no doubt a very significant expense for the large contractors and an unplanned one; besides that, these contractors were not responsible for what had happened since the woman did not work for them. Ironically, small subcontractors were exempted from this requirement (as from many other requirements) and so, we were told, employees of companies of the size the woman worked for did

not have to take the course. Thus DOE in effect punished the large contractors for an event in which their actions were not relevant, as far as we in the trenches could see. This event was widely viewed by ORNL people as an example of how DOE couldn't see the forest for the trees and how DOE was willing to throw money in an indiscriminate way at a problem.