

Note For: Ron Bellamy, RI
Bill Cline, RII
Jack Grobe, RIII
Chuck Cain, RIV
Bob Pate, RV

From: Paul Goldberg, IMNS

Subject: Oak Ridge System for Evaluating Terminated Licenses

I understand from George Pangburn that a number of people had questions at the recent Counterpart Meeting about ORNL's methodology for identifying licenses of concern. The evaluation is based on license files; in some cases, the inspection files are with them, in some cases, they are not. This means, of course, that the information available to ORNL is limited and that the additional step of Regional and/or NMSS review is necessary to determine whether there is contamination at a site. We instructed ORNL to be conservative in identifying sites, i.e. to flag all those which might have the potential for serious contamination. The score assigned to a license does not indicate any absolute risk value; it establishes an estimate of the relative likelihood and magnitude of contamination among the licenses and permits ranking and comparison of the licenses.

As the attached description explains in more detail, ORNL uses an expert system to evaluate the likelihood and possible magnitude of contamination. The system first looks to see if the license can be eliminated for administrative reasons, e.g. it was superseded by another license or it was transferred to an Agreement State. There is provision to override this determination if the site had the potential for serious contamination. The system next assigns a score based on the nuclides and quantities the licensee was authorized to possess. This score considers the form of the material, and inhalation and ingestion dose factors and decrements for half-life. The score is modified by information in the file on licensed activity, closeout and material disposition information, and indications of possible contamination of buildings or the environment (releases, burials, incineration, operational incidents, etc.).

The procedure for sealed sources not accounted for by documentation in the files, also described in the attachment, is simpler: the system calculates a score based on the isotopes and quantities authorized, decremented for half-life.

cc: George Pangburn
Fred Combs

7/16

EXPERT SYSTEM FOR EVALUATION OF RETIRED NUCLEAR MATERIALS LICENSES

Purpose and Function

Written for
Office of Nuclear Materials Safety and Safeguards
Nuclear Regulatory Commission
by
Measurement Applications and Development Group
Health and Safety Research Division, Oak Ridge National Laboratory

Purpose of the system

An expert system is broadly defined as any computer system which makes structured decisions based on information provided to it. The expert system for nuclear materials license evaluation makes a twofold decision about retired nuclear materials licenses:

- decides whether a site or sites of use authorized under the license could presently be meaningfully contaminated, based on activities carried out UNDER THAT LICENSE, and not known to be directly authorized at that site by a subsequent license. See section I on computing the site score for a license.
- identifies sealed sources authorized under the license which were not accounted for at license retirement, and which could represent a present public hazard. See section II on computing a sealed sources score for a license.

Method utilized in the evaluation

For a given physical license file, the initial entry into the system is an inventory record of relevant information present in the file. This inventory record is completed for the approximately 21,000 license files in the boxes in ORNL's possession. At the time the license number is to be evaluated, the expert system evaluator first looks at what types of information are available in each physical license file available for that license number. About 25 per cent of license numbers have more than one physical file in different locations (boxes). About half of these situations are essentially duplicate files. For the other half, the files contain different information. For the expert system evaluation, the file containing the disposition and closeout information is used in the evaluation.

I. Computing the site score or rank of the license

The following information pertains to licenses authorized to possess loose material, or materials handled loose. The information listed below is used in the expert system evaluation, in approximate chronological order of use. The system can loop back for additional information where needed. In each step, the goal of the system is to disqualify (assign a score of 0) to the license based on the information available at that point. For licenses not ultimately disqualified from consideration, the next goal is to compute a site score for the license, based on the information in the file. The score can be thought of as an approximate 'hazard ranking' for the license, and is based on both material hazard and other characteristics of the activity and site. The final license/site-specific score has meaning as a basis for comparison of relative hazard represented by the license, but has no independent numeric meaning.

(1) DISQUALIFYING CONDITIONS

- License superseded by a subsequent license used at the same site(s).
- License transferred to an agreement state (unless sites were closed out during the period of the license, and the state license does not cover those sites).

- No authorization to possess material (distribution or transportation, for example), or no actual possession of material under the license.
- License to import or export only
- Fresh fuel license
- License for a power reactor

For licenses which cannot be disqualified on the basis of such administrative information, subsequent information on materials, licensee activity and closeout (surveys, inspections, disposition) are used to compute the site score for the license.

(2) MATERIALS

• For each material authorized in loose form, the amount of the material and the inhalation and ingestion dose factors for that material are used to compute an initial 'score' for that material¹. The estimated maximum amount of material which could be remaining is first reduced using the half life, using the period of time from retirement of the license to 1990. The dose factors are then used to compute a hazard for the material/amount combination. For licenses with multiple materials, the individual scores are summed to get an initial estimate of the hazard from the loose materials possessed under that license. For licenses with extremely small possession limits, or only low-hazard materials, the license may be disqualified at this point, because of a low cumulative score. Licenses which authorized only noble gases are not included for further consideration.

For broad byproduct materials licenses (those authorizing any byproduct material, or any byproduct material with atomic no. 1-83), the authorized use of the material determines the hazard factors which are used.

(3) ACTIVITY

• The next questions which modify the score concern the activities carried out under the license, and the user's estimate of the degree to which contamination could have been generated by the licensee's activities. This includes the manner in which materials were handled, the frequency of turnover of the licensed amount, generation and handling of waste, possible burials during the period of the license, number of sites, and moving of sites during the period of the license, and airborne or effluent releases. Accidents which could have resulted in serious contamination are also taken into account (e.g. explosions).

(4) CLOSEOUT AND DISPOSITION INFORMATION

Any closeout survey for a license having a score above 20 is given to a person knowledgeable in health physics survey techniques, who then evaluates the survey information to determine to what degree the survey technique and results reduce the likelihood that the site is contaminated, and to what degree it can be ascertained that present standards for unrestricted release were met. Final inspections, disposition of licensed materials, generation and disposal of waste, degree of intermediate and final decontamination are all used to modify the final site score received by the license. Following is a comparison of the degree to which the various factors can change the magnitude of the score. Both the questions asked at any point, and the change in score for a given answer depend in part on the answers to previous questions. Thus, it is difficult to give an exhaustive list of the exact

¹ For source materials and SNM, use of the dose factors would have resulted in enormous scores. Nonlinear functions based on the dose factors are used for each material. Enrichment is taken into account in these functions.

questions and values. The numbers below do give a range of the magnitude of the change in score from the important factors. The order given is an approximate order of magnitude of importance, and does not represent the order in which the system arrives at the questions.

Closeout Survey - The potential for change in score is highest for the closeout survey. When a closeout survey is present, and judged to be very thorough, with no significant findings, the score is reduced by a factor of 10 (e.g. a score of 250 would become a score of 25). Survey quality is judged on the basis of coverage of the potentially contaminated areas, instrumentation and methods of analysis, reporting of results, and appropriateness of the measurements. In particular, for licenses where alpha contamination is likely, a careful check is necessary to be certain that the survey included a thorough alpha survey, and that the limits used matched the material possessed.

For less thorough surveys, or surveys with some significant positive findings not ultimately resolved, the survey may ultimately result in a reduction to 30% of the previous value, up to 90% of the previous score for a survey of little value.

Questions about the closeout survey are at the end of the evaluation. If the score is below 20, no increase in score is given because of lack of a closeout survey. For a license with a score above 20 at that point in the evaluation, the score is increased by a factor of 1.8 if there is no closeout survey. For example, a license with a score of 20 is reassigned a score of 36 if no survey was done. On the other hand, a license with a score of 200 (fairly high) would be given a score of 360 if no survey was done.

Burial or dumping onsite under the license - Depending on the possible magnitude of the burial, the score can be increased by a factor of 2 (200%).

Degree of turnover of the licensed possession limit - The possession limit is an at any time limit. The actual amount of material procured and used depends on how often the licensee turns over the material. If very frequent turnover, the score can be increased by a factor of 1.4. If there were conclusive evidence that the licensee possessed material far below the possession limit, and did not turn the material over, the score can be reduced to 20% of the previous score.

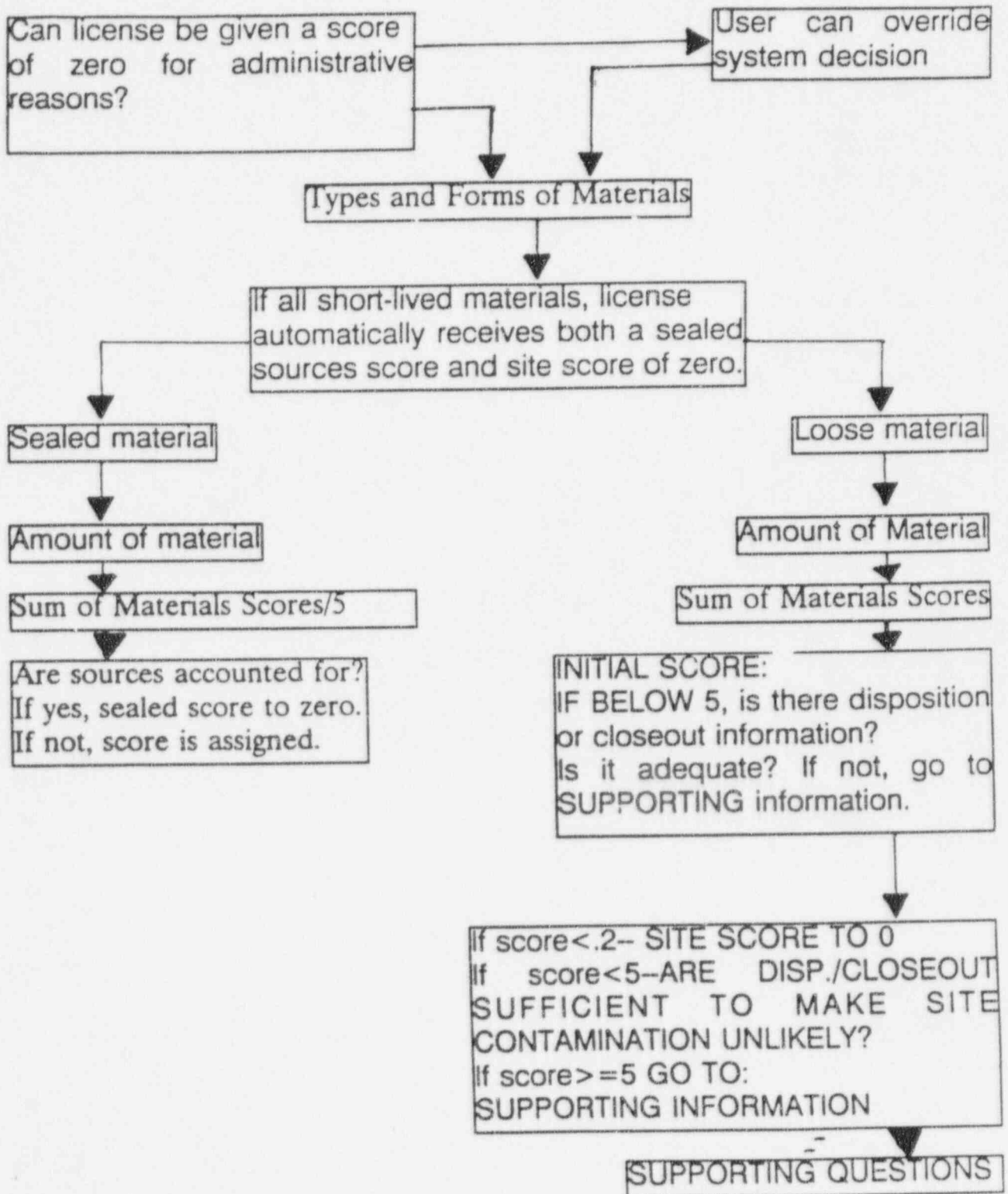
Degree to which building could have been contaminated, based on activities and usage - 50 % to 150 % of the previous score

Degree to which outdoor contamination could have occurred from routine operations or releases (separate from burial or dumping) - 85 % to 150% of the previous score.

II. Computing the sealed sources score

For licenses with sealed sources, the procedure is somewhat different. For sealed sources, the initial questions deal with whether the disposition for the sealed sources at the time of license retirement was adequate. If so, then no further questions are asked. If not, then the materials and amounts are entered, and the expert system computes a hazard score for the sealed sources in the same way as previously described. For very low hazard materials and amounts, the system will then eliminate the license. For sealed sources, the system does not ask for further information, but assigns the hazard score based on the materials, amounts, and upper limit estimates of the remaining amount.

Decision Structure for Evaluation of a License



MODIFYING FACTORS

EXISTENCE OF AN IDENTIFIABLE SITE

ESTIMATE OF THE DEGREE OF CONTAMINATION THE
ACTIVITIES UNDER THE LICENSE MAY HAVE PRODUCED

WAS THERE DOCUMENTED DECONTAMINATION AT CLOSEOUT

WAS THERE AN NRC VERIFICATION LETTER (RELEASE OF SITE)

WAS THERE EVIDENCE OF INCINERATION OR OTHER RELEASE

ESTIMATE OF FREQUENCY OF TURNOVER OF THE MATERIALS

USE OF GLOVE BOXES, HOODS, OR HOT CELL

GENERATION OF OTHER CONTAMINATED MATERIAL (PARTS,
CLOTHS)

DID THE OPERATION GENERATE RESIDUES (SLAG, SLUDGE)

HOW WELL DOCUMENTED WAS DISPOSITION OF LICENSED
MATLS

WAS THERE ANY INDICATION OF DUMPING, BURIAL OR
ABANDONMENT?

EXISTENCE AND QUALITY OF CLOSEOUT SURVEY(S)

EXISTENCE AND QUALITY OF PHYSICAL CLOSEOUT
INSPECTION