DECONTAMINATION AND DECORPORATION

THE CLINICAL EXPERIENCE

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ABSTRACT

Decontamination and decorporation are quite interrelated when dealing with a contaminated person. Some clinical experiences from a transuranium production facility are offered. Skin decontamination is accomplished by washing with detergent and water. Stubborn cases are treated with sodium hypochlorite followed by rinsing, and emery cloth is used on more stubborn nail or finger pad contamination. If inhaled, the usual skin cleansing followed by nasal douce with normal saline decontaminates reachable areas and one of the DTPA salts given via aerosol both decontaminates and decorporates the inner recesses. Saline laxative reduces the time inhaled, and ingested particles remain in the gastro-intestinal tract. Conservatism prevails in general, but most persons found to have inhaled contamination are given a single chelation within the hour of discovery and if subsequently found to have over 10% M.P.P.B. of a soluble actinide are offered further chelation. Single dose chelation has been found to be relatively innocuous and usually sufficient. The longest case of chelation therapy spanned 2-1/4 years and encompassed 123 doses of CaNa-DTPA.

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For the sake of brevity, I shall not give the historial account of decontamination techniques of the past 25 or so years, rather I will briefly touch on the recent clinical usages in a major transuranium processing facility. The contaminants of clinical concern at Savannah River are isotopes of uranium, plutonium, Americium, curium and Californium. Decontamination and decorporation of these actinides are often very difficult to separate in clinically dealing with a contaminated individual. During all this, Health Physics and Medical personnel work as a team.

We have a preplan, however, for heavily contaminated persons. To minimize time of exposure, a decontamination unit is placed in the manufacturing area (Figure 1) which consists of a hot water tank with hose plus a box which contains protective clothing and survey instruments for the helpers, and for the one exposed contains venous tourniquet, detergents, scrub brushes, sanitary pads, hair clippers, blanket and change of clothes. The gross material can be quickly removed and he is taken to the second step, the Health Physics decontamination unit, where he can shower and do a more finite job of cleansing. Here, if hair won't clean up, it can be removed and more sophisticated means are used to cleanse the nose, skin, etc. Should this fail, he is taken by ambulance to the third step, the Medical Decontamination Unit (Figure 2).

To date we have needed no drastic approaches, rather some common sensical techniques have been used, quite successfully.

Hair is scrubbed and scrubbed with detergent and water; if heavily contaminated, the person bends over a sink and has help so as to not spread contaminant over the entire body. If not heavy, a total shower is quite

successful. We have removed hair once only and this on the chest to insure a true lung count. Close clipping sufficed.

Nasal contamination uses a nose blow first, then if needed, a 500 ml saline intravenous set is used, minus the needle, and the person leaning over a sink, douches the nose. Upon completion the whole unit is discarded.

Skin is generally washed with first a surgical soap gently maneuvered with sanitary pads, next by a stronger laundry detergent in like manner, then if this too is unsuccessful, sodium hypochlorite (simple laundry bleach) is applied in a 1:4 dilution several times. For very stubborn cases I have used full strength bleach but quickly rinse it. Should the skin get red or sting, we stop and rest awhile.

Fingernails and the pads of fingers may not respond to these techniques. Here then, fine emery cloth is used. I have had no fingernail refuse to clean up. Finger pads may need to be sanded smooth of all skin whirls before contaminant is all removed. If this fails, the hand is placed in a rubber glove for 8-16 hours to allow perspiration to decontaminate by normal channels. It comes out water-logged but usually clean.

Simple wounds such as punctures or lacerations first have a venous tourniquet applied to promote bleeding, then are cleaned with pad, surgical soap and water. Should this fail, we use the bleach technique.

Some of the wounds will yet require debridement. Puncture wounds of finger pads or fleshy areas are best treated by removing a core of tissue with a dermatology biopsy punch,[1] snipping the end, touching the surfaces with a silver nitrate stick and applying a firm dressing.

Small contaminated burns are cleaned in like manner then a solution of two percent silver nitrate is applied. Any remaining surface contaminant seems to fall off in the eschar.

Avulsed tissue can be cleansed in saline, but if yet contaminated can be cleansed in hypochlorite and applied as a primary graft as it will be clean, yet viable.

Inhaled contaminations usually present the greatest challenges. What is the material, how much was inhaled, is it soluble or insoluble, how long did the person inhale it, does he have hay fever or chronic pulmonary disease? All these need be considered, thus a simple nasal swab only tells that contaminant went at least up the nostrils. Sputum coughed up may or may not tell much more. So after a careful history one gets at least a guess that some of the material reached the lungs. All external contamination is removed by shower, nasal cleansing, etc. Since some of the actinides seem to be more soluble in acid than neutral or basic solution a single dose of 100 grains soda bicarbonate followed by 15 grams of calcium lactate is given orally to neutralize gastric juices, then one gram of DTPA (dicalcium trisodium) diethylene-triamine-pentaaceticacid is given. If the material is a known insoluble, no chelation is entertained, but if soluble, a single dose of chelate is given within the hour. I prefer the aerosol route as it seems more effective in smaller absorbed quantity and seems to be eliminated slower than when given intravenously. This is then followed by one ounce of Fleets phosphosoda which causes evacuation of the GI tract within a very few hours. Experience has indicated that fecal samples collected during the first few days post inhalation contain 60% of the contaminant entering nasapharynx which is translocated into the GI tract. Although not accurate, it gives an

indication of what is to come. Health Physics then does careful monitoring of bioassay samples and depending on these, lung count, etc., will depend on whether further treatment is called for. Naturally the complete blood count (CBC) and urinalysis, et al, are done before and after treatments.

Since about 1952 or 1953, we have had six incidents which were treated with EDTA (ethylene diamine tetraacetic acid). Since DTPA came into use, 184 incidents received 145 single chelations, be it aerosol or intravenous, and one person[2] received a total of 123 doses of DTPA over a 2-1/4-year period. He developed anosmia and hypogusia which cleared spontaneously 100 days after his last chelation. Several of the others received two or three doses of chelate. Some persons had multiple incidents.

One incident, most recently, has received 7 doses of Zn-DTPA. The first three were by aerosol but he objected to the metallic taste and dryness of the throat so following were given IV. This man also had general achiness for a few hours following the second aerosol, but no symptoms from the IV.

Once the bioassay tells us an individual has over ten percent of body burden, we offer to chelate. The Hall Formula,[3] developed at SRP, is used to determine frequency of chelation. We have also on occasion chelated the person who had inhaled insoluble particles. Urinary excretion indicates that all actines are somewhat soluble in lung.

These are some of our clinical experiences we wish to share, both in hopes they may be of some help and also in hopes someone may discover and share with us even better methods of handling a contaminated person.

REFERENCES

1. Vernon PB, Hall RM, Poda GA: Monitoring Decontamination and Bioassay of a Plutonium-Contaminated Injury. Health Physics, vol. 12, pp. 1539-1543, June 1966.

2. Jolly J Jr, McClearen HA, Poda GA, Walke WP: Treatment and Evaluation of a Plutonium-238 Nitrate Contaminated Puncture Wound -- A Two-Year Case History. Health Physics, vol. 23, pp. 333-341, September 1972.

3. Hall RM, Poda GA, Fleming RR, Smith JA: A Mathematical Model for Estimation of Plutonium in the Human Body From Urine Data Influenced by DTPA Therapy. Health Physics, vol. 34, pp. 419-432, May 1978.

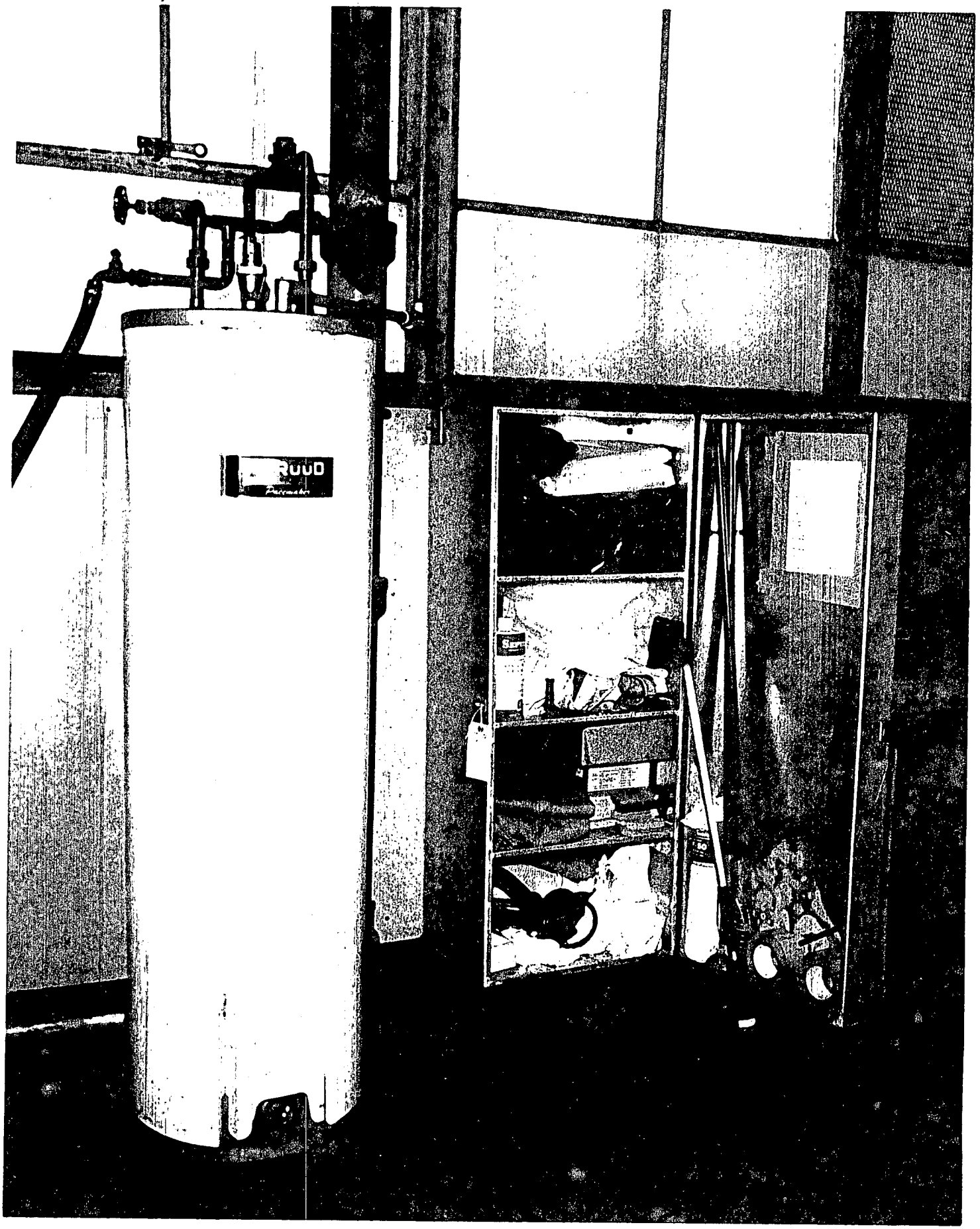

Figure 1

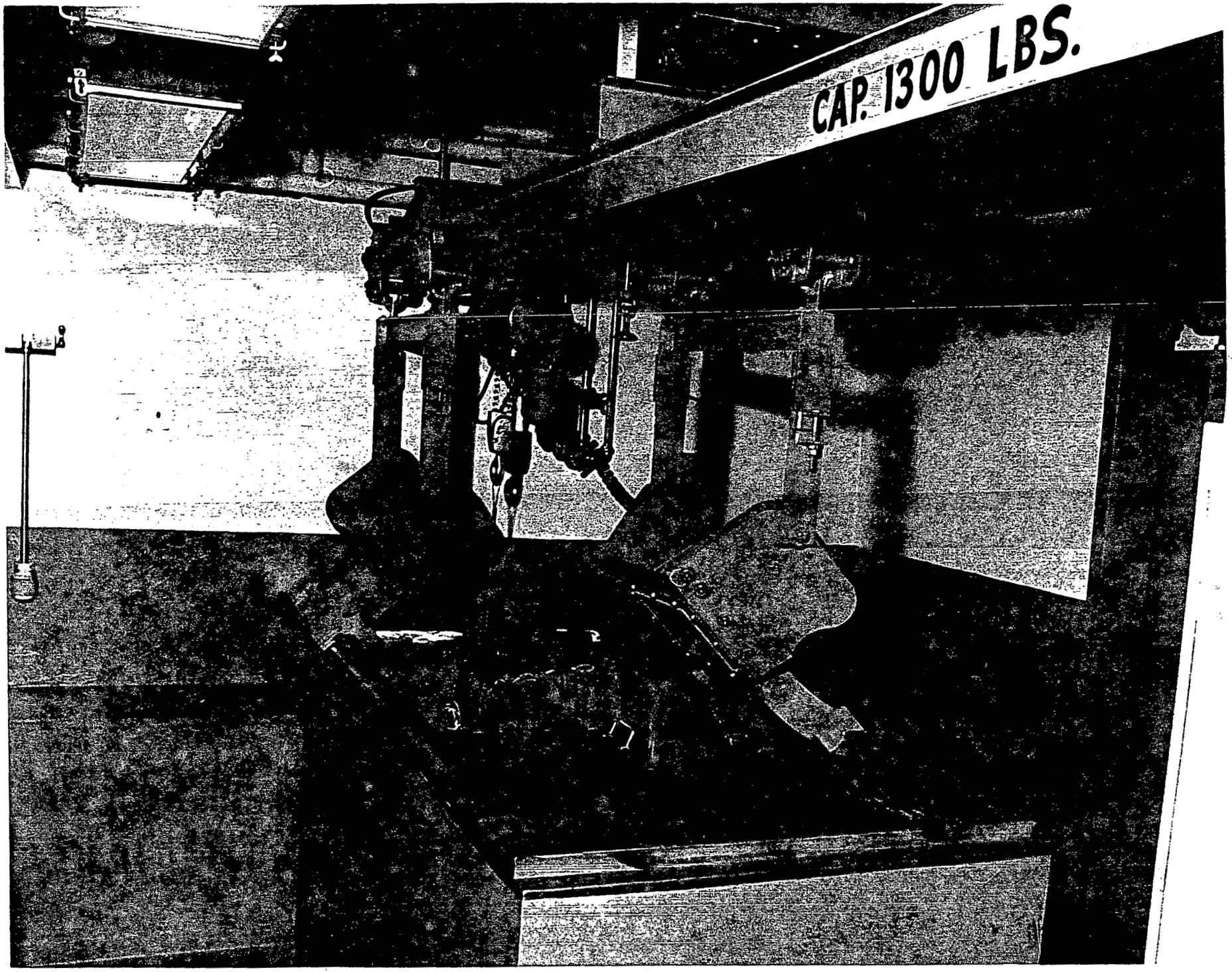

Figure 2

DPSPu--79-30-19

EDB ☑ ALD ☐ ☐
ERA ☑ INS ☑ ☐
EPA ☐ RIP ☐ ☐ 018378
WDA ☐ GAP ☐ ☐

CATEGORIES
1. 054000
2. 520157
3.
4.
5.

AUGMENTATION:

SPLIT	DESCRIPTORS	FLAGS
	Personnel	T1
	Decontamination	01
	Nuclear Facilities	
	Chelates	
	Chemotherapy	
	Actinides	

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