# SAR CHECKLIST

| Subject | Vol. | Source | Loc. | | Comment |
|---|---|---|---|---|---|
| Shielding (design obj) | P/F | S.F. 12.1.1 | T | Desc. design obj of plant shield for n.o., incl. a.o.o., w.r.t. 10CFR20,50 | |
| (design descr) | P | S.F. 12.1.2 | F | Scale layout + x-sect. of buildings containing process equip for treatment of rad. fluids | |
| | F | S.F. | F | Detailed plant layout w/outside stor area + R.P. side | |
| | P | | T | Desc. design crit for erect + dim of shield penet of shield wall, accept rad level in C.R. valve station, sample area + other areas occup | |
| | P | | T | Justification of shield thick, incl geom + penetrations for each source in 11 12.2 model | |
| | P | | F | CR layout + isometric view w/shield thick for GDC 19 | |
| (plant layout) | P | S.F.R 12.3.1. (Reg) (old S.F. 12.1.2) | Q | Provide illustrative ex. of facility design features (placement, shield thickness, contam contr., vent) for liq. filters, demin, tanks, evap, pumps, value op, stat + sampling stations. | |
| | P | S.F.R. 12.3.1 (Reg) (old S.F. 12.1.2) | F | Provide scaled layout + array drawof fac. w/sources + rad zones (w/bound for normal + refuel cond) showing wall thick, contr access area, personnel + equip decont area, contam control areas, traffic patterns, loc of H.P. fac., loc of airborne mon, loc of contr panels for radwaste equip components loc of onsite lab for analysis of chem + rad samples + loc of counting room (see if in high rad zone) | |
| | P. | | T | Specify design basis rad level in count Room during n.o. a.o.o | |
| | P | Reg Guide 8.8(R) | F | Fuel pool Area in Zone II area | |
| | P | | F | Major compon (tank, dem, pump, fitter, val) shielded from each other. | |
| | P | | F | Access to rad component from <1 mr/hr zone does not require exp to other major rad comp | |

| Subject | Vol | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| Shielding (plant layout) | P | Reg Guidr 8.8(R) | F | Rad cubicle to have floor to ceiling walls + labyrinth roofed cut with no line of sight to cub or layout zone + w/ minimal penetration streaming | |
| | P | | T/F | Sep. rad. pipes, shield rad pipes, pipe spares in pipe chases where pipe lifetime < 40 yr | |
| | P | | T/F | Local sampling sta. in own cub. w/ little piping, flushable sampling lines, + accesible from low radzone | |
| | P | | F | Each major comp. able to be replaced w/o major struct changes (evap, waste drums) | |
| | P | | F | Pumps shielded from tanks (also valves) | |
| | P | | F | Moisture sep. + heaters below turbine (BWR) | |
| | P | | F | Adequate locker room for men + women | |
| | P | | T/F | Des. control access to high rad. zones | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | P | | T | All processes oper. by remote man. or automatic initiation from low rad zone | |
| | P | | T | If not in clean pipe chases, clean services (air, $H_2O$ + N) should be in rad pipe chases only if inst. they are designed for life of plant + have no valves | |
| | P | | T | Rad fluid valves should be in own cubicles with manual operation outside walls. | |
| | P | | Q | Decontaminatable walls in rad cub (ANSI 101.1) | |

| Subject | Vol | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| Shielding (plant design) | P | Reg Guide 8.8(R) | Q | Adequate + quick service lights in cubicles | |
| | P | | T | Instr, readout, + contr w/no rad fluid installed in low rad zone, Minimal rad instr. preferred | |
| | P | | Q | Cubicles w/rad. fluids to have sloped floors to drains; drain lines run in concr., cols, radwaste pipe chases. Local loop seals not used in radwaste; no backgassing | |
| | P | | Q | Interconnections between compon. for servicing | |
| | P | | Q | Provisions to drain + clean sumps remotely + periodically | |
| | P | | Q | Use long-lived + easily maintained instr, readouts + controls | |
| | P | | Q | Process equip capable of being isolated, drained, purged + cleaned w/aux. vent to clean room atm. | |
| | P | | Q | If single failure of critical comp. prevents cleanup or purge of radwaste sys, additional permantly avail. scheme (redund outlet valves or pumps on tanks) should be employed to complete cleaning operation. | |
| | P | | Q | Resin transport or storage systems to have spacial A consid, | |
| | P | | Q | Liquid filters to be drained + purged prior to removal + should be removed + changed remotely. Filters + screens located downstream from demin | |
| | (P | | Q | Field run rad. piping routed for min. personnel exp. | |
| | P | | Q | For multiple units, piping + layout designed for minimum construction worker exposure | |
| | P | S.F.R 12.3.1 | T | Describe fac + equip such as hood, glove box, filters, special handling equip + special shields related to use of SNM, source + by product mat. | |
| | P | S.F.R. 12.3.2 | T | Provide shield info for each rad. source in 12.2, incl. crit. for pen., mat., methods by which shield param (x-sect, atten coef, buildup fact) were determ + assumps, codes + technique used in calc. | |

| Subject | Vol. | Source | Loc. | | Comment |
|---|---|---|---|---|---|
| Shielding (plant design) | P | S.F.R. 12.3.2 | T | Desc. special prot. features that use shielding, geom. arrang., or remote handling to assure ORE. ALAP in areas such as valve operating stations + sample collection stations. | |
| | P | | T | Followed Reg. Guide 1.69 and B.B. | |
| (source terms) | P | S.F. 12.1.3 | T | Total quantity of principal nuclides in process equipment that contains or transports rad. should be identified + expected max. + avg. values of radioisotopic inventory stated | |
| | P | | T | Provide est. of dose rate at site boundary per curie of stored waste (ind. ship cask) | |
| | P | | T | Contribution to expos. of N-16 from turbine bldg | |
| | | | | | |
| (area mon.) | P | S.F. 12.1.4 | T | Provide loc + design crit. of types of instr. for area mon. + crit. for loc. of equip. (e.g. max. dose in area lower than det. range) | |
| | F | | T | Desc. instr. operational char, detector type, sensit, range, method of calib, setpoints, loc. + type of annunciators + alarm (+ the sys or operator actions they initiate) + desc. maint. + calib prog. to be followed. | |
| | F | | T | Ind. type + loc. of power sources, + indicating + recording devices + manner in which data recorded | |
| | F | | T | Include accid. considerations + other needs for high ranges of instrumentation + aux. equipment annunc in C.R. ? | |
| | P/F | STANDARD REVIEW PLAN | T | Mon. calib routinely, local alarm + var. setpt, readout + | |
| | | | | | |
| (operating proc) | P | S.F. 12.1.5 | T | Desc op. proc. to keep ext. exp. ALAP during oper + maintenance. Cite previous experience | |

| Subject | Vol | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| Dose Asses | P | S.F.R 12.4 | T | Provide est. occup. of plant rad. areas during n.o. & a.o.o. & estimate man-hours for areas (use past experience) with expected airborne rad. conc. | |
| | P | (old S.F. 12.1.6) | T | Provide obj & crit. for design dose rates in various areas & est of annual man-rem doses (peak ext-dose rates) assoc w/maj funct such as operation, maint, C.R., boundary radwaste handling, refueling & inservice inspect | |
| | P | | T | Describe any measures taken to reduce particular estimated man-rem doses for specific functions in cases when the dose would appear to result in excess personnel costs to avoid overexposure | |
| | F | | T | Tabulate est. annual occupancy for each rad zone & provide bases & updated estimates | |
| | P | (old S.F. 12.1.1) | T | Provide est. annual dose rates (exposure) at boundary of the rest area & for, multi-unit plants, at | |
| | P | | T | various loc. in new unit constr. area | |
| | P | | T | Provide est annual doses to constr. workers due (ALAP) to rad from these sources & annual man-rem doses | |
| | P | S.F.R. 12.2.1 | T | Rad sources in radwaste managn. syst. equip. should be described in Chap. 11 | |
| | P | | T | Provide source descr. for reactor core (source as it is used to deter. rad. levels exter. to biological shield where occupancy requir) | |
| | P | | T | Provide source descr. for spent fuel stor. pool var. aux. syst., steam lines, turb sys (incl. reheaters, moist sep.) as N-16 sources (BWR) & A-41 (PWR) - should tabulate sources by isotopic comp or gamma Egrp, strength (curie) & geom | |

| Subject | Vol. | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| Dose Asses | P | S.F.R. 12.2.1 | T | Desc. by prod., source, or SNM requiring shielding | |
| | F | | T | Provide listing of isot., quan, form, + use of all sources in latter categ. that exceed quan in Tab 12-1 | |
| Ventilation (design obj) | P | S.F. 12.2.1 | T | Describe design obj for plant vent sys. for n.o.+ a.o.o. w.r.t. pers. prot. + regulr. of 10CFR20,50 | |
| | P | | T | Max + avg airborne rad. level for n.o.+a.o.o. allowed in plant struct.+ restr. area where plant pers., constr. workers+ site visitors are permitted should be identified | |
| (design descr) | P | S.F.R. 12.3.3 | T | Provide illust. ex. of air cleaning sys. design w/ ex. layout of air cleaning sys. housing showing filter mount, access doors, aisle space, service gall + provisions for test, isolat.; decont. | |
| | P | S.F. 12.2.2 | T | Provide complete descr. in rad. build, incl. build. vol., expect flow rate + filter char. | |
| | P | | T | Give C.R. vent sys. descr. to meet GDC. 19 incl. loc of air intakes + filter char. | |
| | P | S.F.R. 12.3.3 | | Provide crit. for easy + safe change out of air filt. + absorbers in air cleaning sys + how often changed | |

| Subject | Vol. | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| Ventilation (design desc) | P | S.F.R. 12.3.4 | T | Was Reg. Guide 1.52 followed? | |
| (sources) | P | S.F.R. 12.2.2 (reg.) (old S.F. 12.2.3) | T | Sources of airborne rad. mat. in equip cub, corridors + op. areas normally occup. should be desc. in manner required for personnel prot measures + dose assessment (size, shape, loc, magnitude) | |
| | F | | T | Tabulat. of calc. conc. of airborne rad. mat. by nuclides expected during n.o. + a.o.o. for equip cub, corr, + operating areas normally occup by operating personnel (Specify assump used to arrive at quant. values) | |
| (airborne rad. mon.) | P | S.F. 12.2.4 | T | Descr fixed area rad + cont. airborne rad mon. instrumentation + crit for placement + loc. | |
| | F | S.F.R. 12.3.4 (Reg) (old S.F. 12-2.4) | T | Provide info on aux. and/or emerg. power supply, range, sens., accuracy, calib methods + freq., alarm set pts + their bases, record devices, + loc. of det., filter char., readouts + type + loc. of annunciators + alarms + sys or operations they initiate, + maint + calibrat. program to be followed for mon. instr. | |
| | F | | T | Provide loc of airborne mon-sample collectors + give details of sampling lines + pump loc. | |
| | P | | T | Desc crit + method for obtaining rep. in-plant airborne rad conc. from area being sampled | |

| Subject | Vol. | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| Ventilation (airborne rad. mon.) | P | staff | T/Q | Are vent mon. sensitive enough to detect 1 MPC in 2hr. in any room | |
| | P | staff | Q | Do mon. read both upstream + downstream reading? | |
| | P | staff | T/Q | Put CAM. in fuel handling, radwaste + C.R. | |
| | P | S.F. 12.2.4 | T/Q | Desc. any port. inst. or grab sample method to check fixed systems | |
| | | | T/Q | Indicate manner in which data recorded | |
| | P | S.F.R. 12.3.4 STANDARD REVIEW PLAN | T/Q | Have R.G. 1.21, 8.2, 8.6 + ANSI N13.1-1969 been followed? | |
| | P/F | | T | Mon. calib. routinely, local alarm + var. set pts, readout + annunc in CR. | |
| (oper. proc.) | P/F | S.F. 12.2.5 | T | Provide desc. of plant op. proc. to assure onsite inhalation exp ALAP (details in FSAR) | |
| (dose assess.) | P | S.F. 12.2.6. | T | Est. exp annual inhal. doses to plant personnel + peak air conc. for each building | |
| (design features) | P | Reg. Guide 8.8 (R) | Q | Adequate space between air filtr. units + between elements within unit for ease of maint. | |
| | P | | Q | Reduce A-41 prod in PWR cont. by 1) reduce vol. of air to cool reactor cavity | |

| Subject | Vol. | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| **HEALTH PHYSICS** | | | | | |
| (Program obj. & organ.) | P | S.F. 12.3.1 | T | Desc. H.P. program organization & objectives | |
| | P | S.F.R. 12.5.1 | T | Desc. admin. org. of H.P. prog. incl. authority and responsibility of each position | |
| | F | | T | Desc experience & qual. of personnel responsible for H.P. prog. & for handling & monit. of rad. mat.; incl. SNM, source, & byproduct mats. | |
| (procedures) | F | S.F.R. 12.5.3 | T | Desc. rad. protection training programs | |
| | P | | T | Did appl. follow R.6, 8.8(c2), 8.7, 8.9, 8.10, 1.8, 1.16, 1.37 | |
| | P | | T | Desc. methods & prac. for personnel monitoring (ext - whole body count; int - bioassay) | |
| | P | | T | Desc. methods & prac. for evaluating & contr. potential airborne rad. conc., incl. any requir. for special air sampling & the issue & use of respiratory prot. devices incl. training & respiratory prot. equip. fitting programs | |
| | F | Reg Guide 8.8 (R) | T | Complete tasks in least time practicable | |
| | F | | Q | Train pers. for high exp. jobs by dry runs & mockups | |
| | F | | Q | Use min. pers. in rad. field for safe op. | |

| Subject | Vol. | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| HEALTH PHYSICS | F | STANDARD REVIEW PLAN | T | Desc physical + admin (Work-permit program) in rad areas precaut to control access + stay time↑ | |
| (procedures) | F | | T | Contr. storage + movement of rad. mat. + control expos. + contam. | |
| (facilities) | P | S.F.R. 12.5.2 | F | Check layout for: office ( ); work area ( ); control pt. ( ); small wet lab ( ); counting room ( ); laundry-spread of contam (storage of clothes affects background + other detectors) ( ); adequate locker rooms (men + women) ( ); calibration area ( ); ≥ 1 H.P. station ( ); decont. area w/mon ( ); fac. + eq to clean equip ( ) | |
| (equipment + instrumentation) | P | | T | Check for pers. mon (daily reading of film badge, etc), portable mon (30-40, γ, β) + portable air sampling equipment. | |
| | P | S.F.R 12.5.2 (Reg) (S.F. 12.3.2) | T | Desc. crit. for selection of port + lab. tech. equip. + instr. for rad. monit. + contam. surveys + describe instr. Storage, calibr. + maintenance facilities. | |
| | P | (Reg) (old S.F. 12.3.2) | T | Desc. H.P. facil., lab facil, protective clothing, respir. prot. equip., decontam. facil., handling methods + special shielding for external protection | |
| | F | (old S.F. 12.3.2) | T | Desc type of det + mon + quantity, sensitivity, range, + frequency + method of calib, + location | |

| Subject | Vol. | Source | Loc. | | Comments |
|---|---|---|---|---|---|
| O.R.E. A.L.A.P. | P | S.F.R. 12.1.1 | T | Policy w.r.t. plant design to make O.R.E. A.L.A.P. | |
| (policy cons(!)) | F | | T | " " Constr. + operation " " " " | |
| | P | | T | Is guidance in R.G. 8.8, sect C1 + 8.10 used? | |
| (design consid) | P | S.F.R 12.1.2 | T | Desc. facil. + equip design directed to ORE ALAP | |
| | P | | T | Descr. how design is directed toward reducing equip. maint. + reducing rad. levels + time spent where maint. is required. e.g. pumps + valves requiring little maint. remote valves | |
| (oper. consid) | P | S.F.R. 12.1.3 | T | Desc how plans + proc. for ORE ALAP were developed + how they will impact on the design of the facility (Follow 8.8. sect C4) | |
| | F | | T | Desc. proc + methods of operation used to assure ORE ALAP | |
| | F | | T | Desc. how operational requir. are reflected in the design considerations desc in 12.1.2 + rad. prot. features in 12.3.1. | |
| | F | | T | Provide the crit. and/or conditions under which proc. + techniques for assuring ORE ALAP are implemented on all sys. which contain, collect, store, or transport rad. liqs. gases, + solids (incl, e.g., turb sys (BWR's); NSSS; RHR sys; spent fuel trans., storage, + cleanup sys; + radwaste treatment, handling + storage sys.) e.g. don't put pump switch on pump. | |

# FSAR QUESTIONS FROM 8.8
# HEALTH PHYSICS

a) Radiation and contamination levels should be reduced by removing radioactive material by draining, flushing, decontaminating, etc.

b) Portable shielding should be provided to reduce hot spot and general work area radiation levels.

c) Temporary, filtered ventilation and full utilization of the permanent ventilation systems should be provided to reduce the potential for inhalation of radioactive material.

d) Respiratory protection should be provided in accordance with Regulatory Guide 8.JC.

e) The smallest practicable amount of time should be used in completing tasks in radiation zones.

f) Mock ups and dry runs should be used to train personnel for high exposure jobs.

g) The smallest number of people consistent with safe operation should be used.

h) Provision should be made for coping expeditiously with accidents, such as spills and fires, which may occur.

i) Adequate supervision and health physics surveillance should be provided to assure that procedures are followed, that planned precautions are observed, and that all radiation hazards are identified.

j) Personnel monitoring equipment, such as direct reading dosimeters, should be used to provide early evaluation of individual doses and the assignment of those doses to specific operations (See Regulatory Guide 8.4).

k) Contamination control provisions should be provided, including disposal coverings for contaminated surfaces and items to permit unencumbered access to work areas.

l) Sufficient radiation and contamination monitoring instruments should be calibrated, tested, and provided so that reliable data is obtained for hazard evaluations. (See Regulatory Guide 8.6).

# FSAR QUESTIONS FROM 8.8
# HEALTH PHYSICS

m) Post operational debriefings for high specific exposure accumulating jobs should be conducted to identify shortcomings in job preparations and to suggest improvements for use in similar operations in the future.

n) A radiation work permit program should be implemented that provide a record of the doses received, contamination levels encountered and individuals involved in each operation.

o) As much work as practicable should be performed outside radiation areas.

p) Personnel access to and exit from work areas, services and communications should be planned to minimize exposures.

q) Special tools, jigs and fixtures as well as remote handling and communication equipment should be used.

r) Radiation levels should be posted near the entrances to the work area, identifying the maximum and average radiation levels.

s) The working environment should be made comfortable to increase efficiency and reduce time spent in radiation areas.

t) Man-rem estimates should be made and goals should be established for jobs involving significant exposures.

u) The management of each station having one or more units containing fuel should either (1) qualify and designate at least one member of each shift operating crew to implement radiation protection procedures, including routine or special radiation surveys using portable radiation detectors, use of protective barriers and signs, use of protective clothing and breathing apparatus, performance of contamination surveys, checks on radiation monitors, and limits of exposure rates and accumulated dose, or (2) assign a health physics technician to each shift operating crews in accordance with (1) above.