U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: POTENTIAL SYSTEM THERMAL MANAGEMENT OPTIONS

PRESENTER: DR. D.R. GIBSON

PRESENTER'S TITLE AND ORGANIZATION: MANAGER, SYSTEM ANALYSIS
CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM
MANAGEMENT AND OPERATING CONTRACTOR

TELEPHONE NUMBER: (703) 204-8893

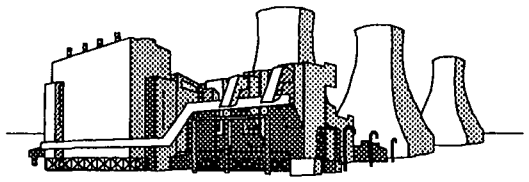
WASHINGTON, D.C.
NOVEMBER 17-18, 1994

THERMAL MANAGEMENT OBJECTIVE

- Evaluate system operational alternatives with potential to:
  - Increase thermal flexibility
  - Increase operational efficiency
- Provide input for overall thermal strategy development

INTEGRATED THERMAL MANAGEMENT ACROSS SYSTEM ELEMENTS

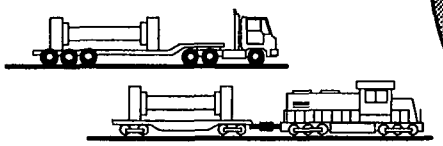
UTILITIES



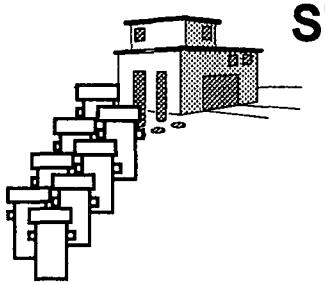
Waste Selection

REDUCE TOTAL HEAT LOAD

REPOSITORY OPERATIONAL OPTIONS

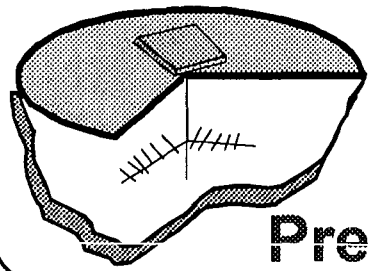


STORAGE



Aging

REPOSITORY(s)

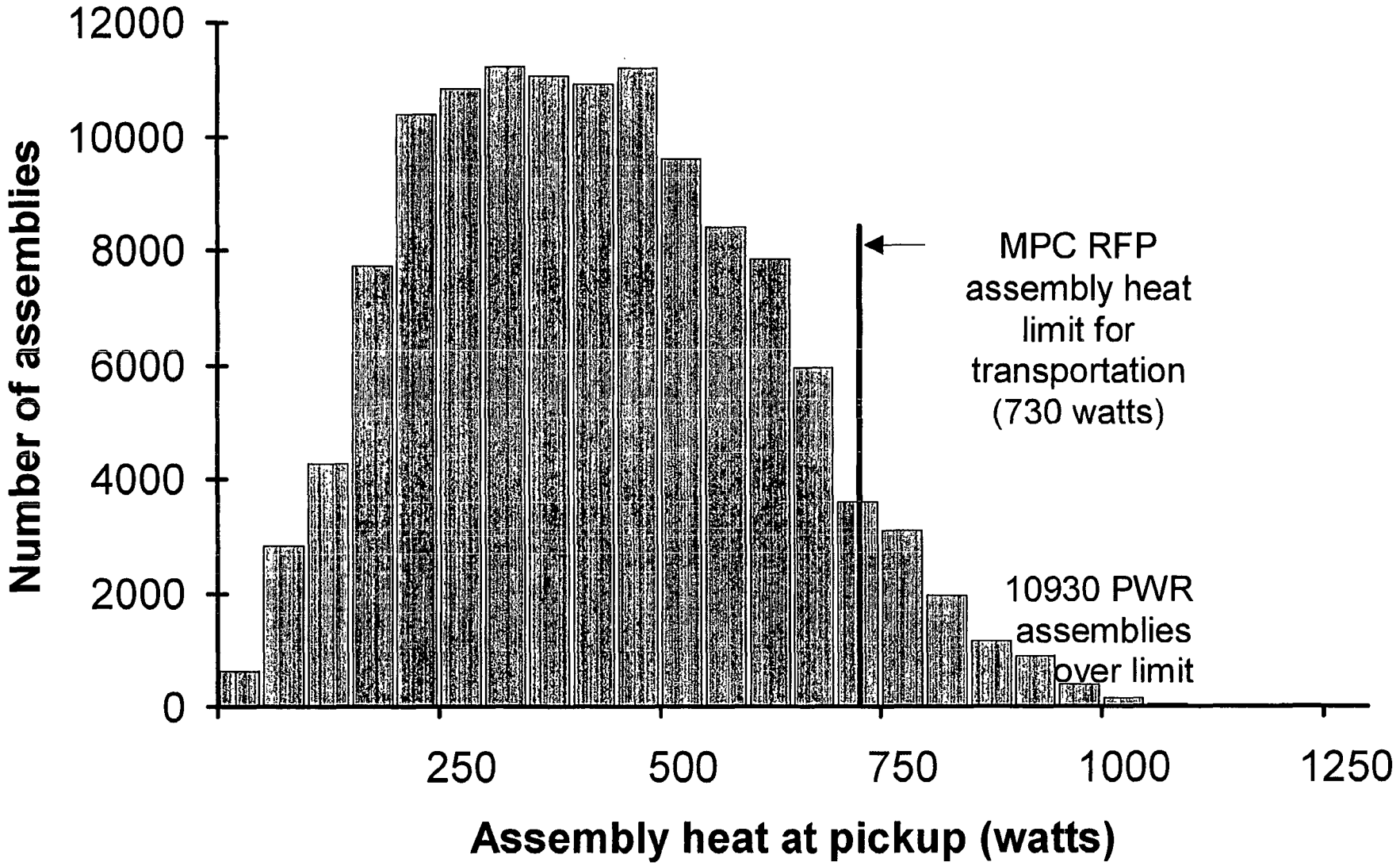


Emplacement
Pre-closure operations

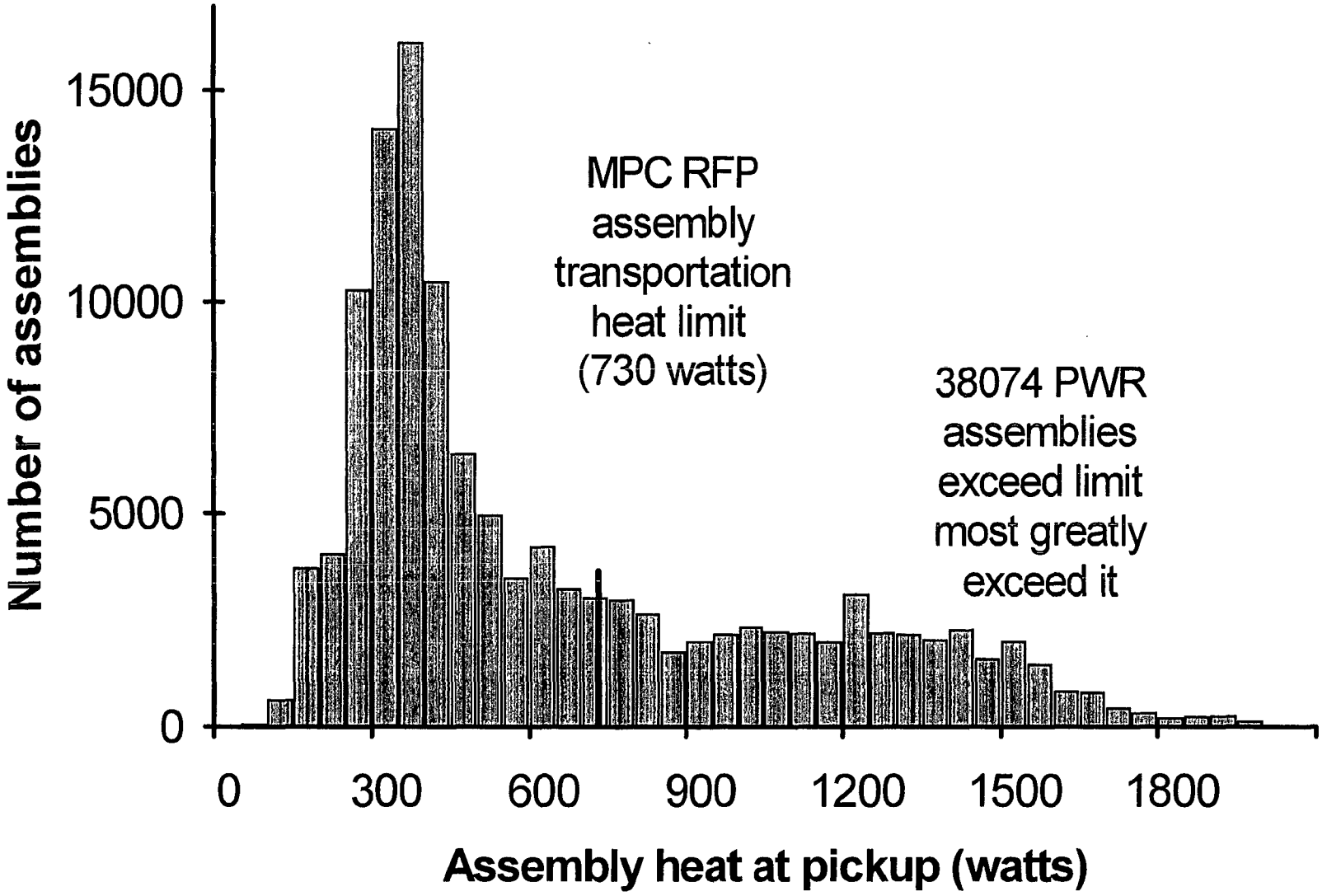
Effect of Selection Strategies

- Delay pickup of hottest packages
  - provide maximum on-site aging of fuel
  - examples illustrate bounds (OFF, YFF5)
- Approach must recognize institutional constraints to pickup strategies

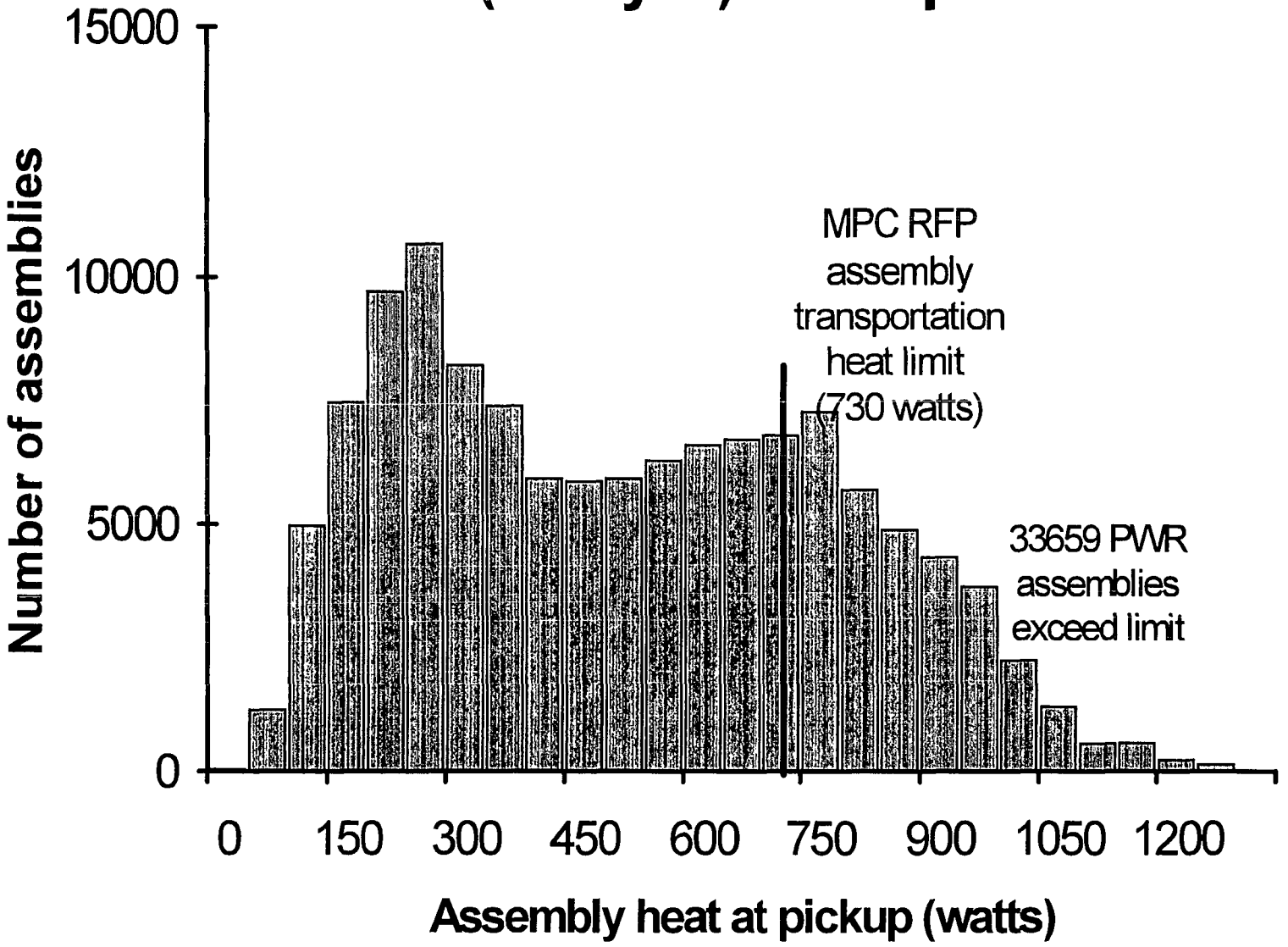
Example of Effect in a Simple Model
OFF Pickup



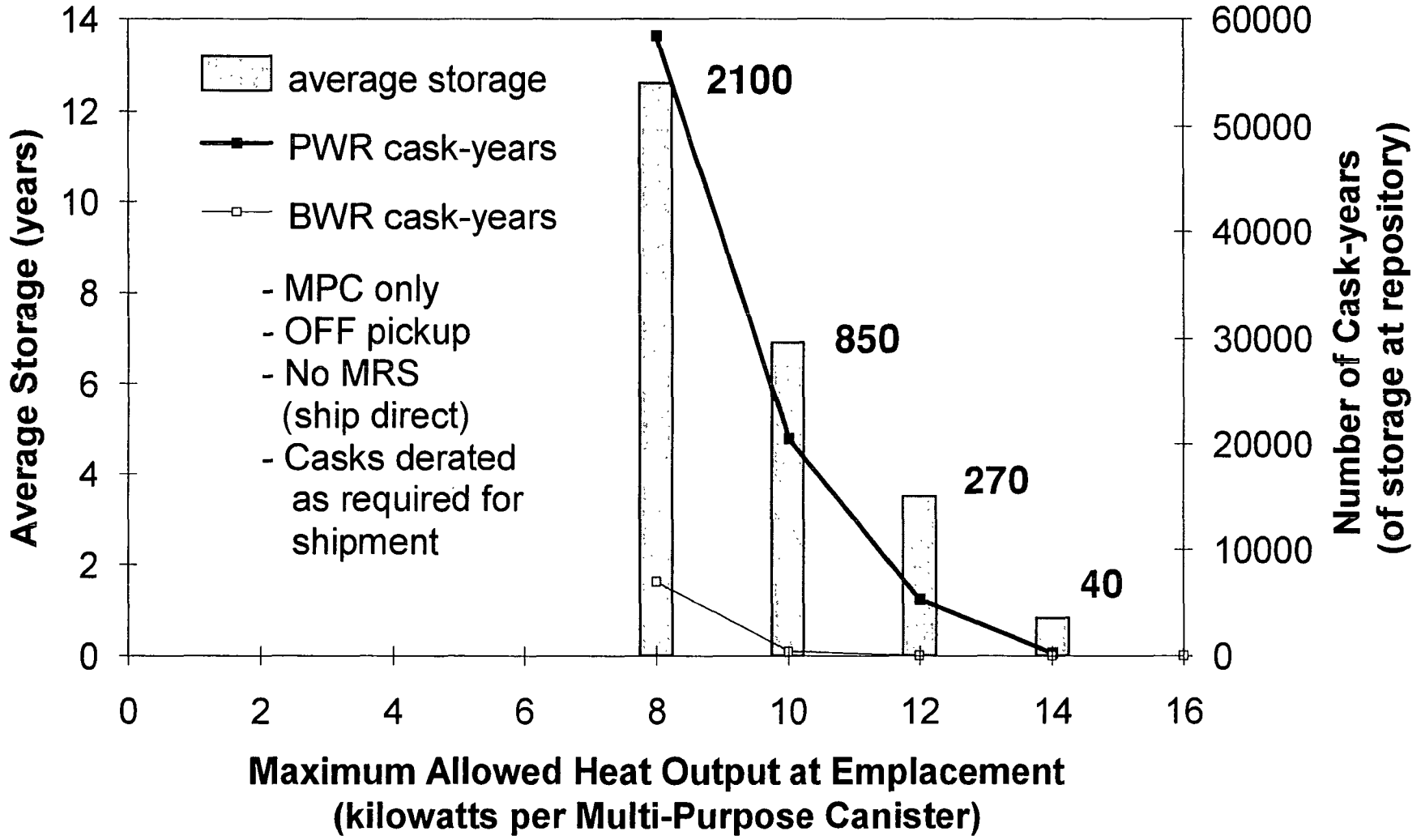
Example of Effect in a Simple Model
YFF(>5 yrs) Pickup



Example of Effect in a Simple Model
YFF(>10 yrs) Pickup

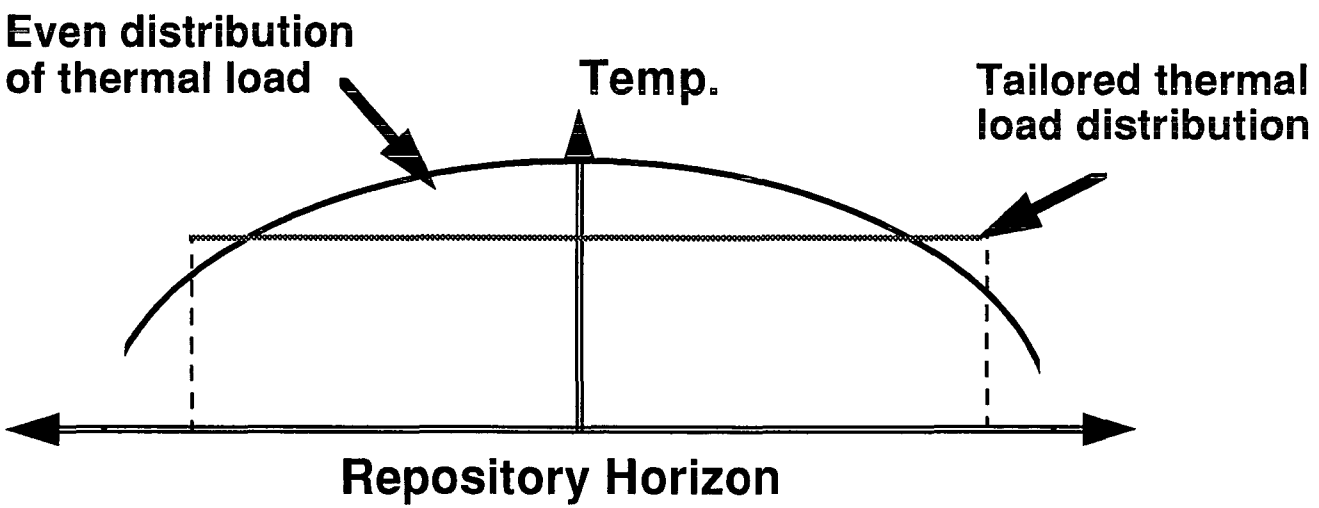


Further Evaluation In Simple Model
Delay Emplacement of Hottest Packages



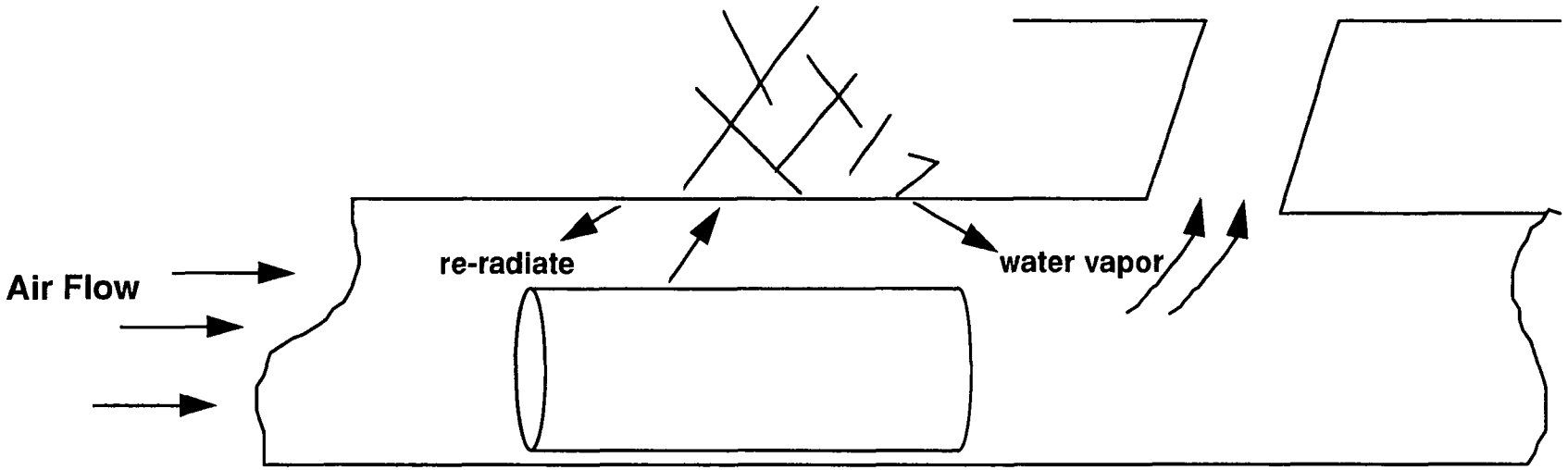
Waste Package Spacing Example

- **Equalize heat-load/unit-length among all packages that are spaced in the interior**



Potential Effect Of Removing Water Vapor During Ventilation -- Latent Heat Removal

- Turnover air in waste-drifts through ventilation
  - remove water vapor flowing from rock
- Use negative pressure in emplacement-drifts to direct vapor flow from rock



Factors Can Reduce Repository Horizon Heat-loads Increasing Emplacement Flexibility

- **Possible Sources of Design Margin** — Factor
  - **Avoid picking up hotter than OFF spent fuel** (~1.25)
  - **Age hottest fuel prior to emplacement** (~1.12)
  - **Higher thermal load near edge of repository** (~1.12)
  - **Remove warm moist air during operations** (~1.05-1.25)
- **Combined factors allow more flexible design**

$$(1.25*1.12) * (1.12*1.25) \sim \mathbf{2}$$

SUMMARY

- Options are applicable for all potential repository thermal loads
- Preliminary analyses suggest overall strategy may benefit from combination of
  - Waste acceptance from utilities
  - Aging hotter SNF prior to emplacement
  - Emplacement spacing
  - Ventilation
- Need to be careful; these are preliminary scoping studies
- Thermal management options must take into account institutional framework