Though the review group agreed on other areas, its lack of consensus on the two most volatile waste policy issues reflects the divisiveness and criticism that have plagued the Department of Energy's handling of the waste problem (see p. 47).

The President was given three options on site selection for a HLW respository:

- To select a site after two or three geologically diverse candidate sites have been found qualified for Nuclear Regulatory Commission review. This option puts the date of site selection at 1982, with a repository operational by 1990.
- To select a site from four to five geologically diverse, NRC-qualified sites. This choice places site selection at 1985; an operational repository at 1993.
- Wait until a comprehensive waste management plan is completed in 1981 before deciding when to select a site. This could lead to schedules similar to the first two options or to a slower schedule.

For defense-funded WIPP (which was originally planned for low and intermediate level defense wastes, and some experiments with defense HLW, but more recently also considered for commercial spent fuel rods) the review group outlined four options:

- Use WIPP as mentioned above, for defense as well as commercial wastes.
- Use WIPP for low and intermediate-level defense wastes only.
- Plan some facility to take combined wastes, but delay site selection.
- Drop WIPP as a project but consider the site for a HLW repository.

According to one government source, the review group's vote directly countered DOE's present policy on these issues and went heavily to the conservative side: to wait on site selection until a comprehensive plan is completed and to drop WIPP as it is now planned. WIPP is already in financial straits; because of its now-commercial bent, the House Armed Services Committee last May completely cut its appropriations for the project. □

Cosmonauts set record

Only three days after the U.S. Skylab space station descended to earth, spreading pieces from the Indian Ocean across Australia to the Pacific, two Soviet cosmonauts set an endurance record for human beings in space. At 10:42 p.m. EDT on July 14, aboard the Soviet Salyut 6 orbiting station, cosmonauts Vladimir Lyakhov and Valery Ryumin broke the previous mark of 139 days, 14 hours, 48 minutes, set by another cosmonaut crew aboard the same facility. The record before that about 96 days, was also set by Soviet spacemen, who eclipsed the 84-day mark set by the third and final crew of U.S. astronauts aboard Skylab in 1974. Several pairs of cosmonauts have made use of Salyut 6, which was launched in September of 1977. □

Charting the human chromosomes

The organization of human genetic material is of great interest and medical value, but human chromosomes remain terra incognitae compared with the chromosomes of the popular laboratory organisms, bacteria and fruit flies. While the number of genes that have been identified on human chromosomes has been growing (from 3 genes in 1971 to 202 in 1978), making a complete map of the human genes remains a formidable task. Frank Ruddle of Yale University told the XIth International Congress of Biochemistry in Toronto that at the present rate, mapping 2 to 3 genes per month, only 1 percent of human genes will be located by the year 2000. But with techniques now being developed, based on DNA manipulation procedures, he expects speedier progress. "It should be possible to map the great majority of human genes by the turn of the century with the marriage of recombinant DNA procedures and somatic cell procedures," Ruddle predicts.

Great range and greater resolution are the goals of new procedures of gene mapping. Ruddle and colleagues have established a variety of methods for locating human genes by moving pieces of human chromosomes into laboratory-cultured cells of other animals. In the past a human gene in an animal cell was identified by detecting its product. The gene then could be mapped to the pieces of chromosome, visible by special staining, in the cell.

Many important genes, however, cannot be detected by their products. Some genes are expressed only briefly during development or only in special types of cells. Some, for example those that regulate the expression of other genes, produce too little material for scientists to detect.

It is now possible, however, to locate specific gene sequences directly, rather than by detecting their products. With recombinant DNA techniques, scientists are able to tag the gene under investigation and then determine to which chromosome it binds. With this procedure Ruddle and collaborators have located the human genes that code for the protein portions of hemoglobin. The alpha globin gene is on chromosome 6 and the beta globin gene on chromosome 11. The researchers have also located on mouse chromosomes several genes for mouse immune system proteins. "We can map specific and unique genes," Ruddle says. "It should be possible to map from one end of the genome to the other."

The scientists are not satisfied with simply learning which chromosome contains a specific gene, however. They want to know just where on the chromosome it lies. To get a more precise location of a human gene, they transfer smaller and smaller pieces of a human chromosome into an animal cell.

With recent refinements of a technique called chromosome mediated gene transfer, the biologists move pieces of human chromosomes into mouse cells. One piece of human chromosome 17, for example, was found to contain the genes for galactose kinase, procollagen 1 and thymidine kinase. Ruddle finds that human genes are unstable at first, tending to be lost as the mouse cell divides. Some of the human segments are partially degraded but then acquire an important piece of mouse chromosome, the centromere. Thereafter, those segments are accurately replicated and distributed to daughter cells during cell division. (This gene stabilization resembles that described for plasmids carrying drug-resistance genes [SN: 12/16/78, p. 421.])

Chromosome pieces so small they cannot be seen with a light microscope are also being transferred between cells. Ruddle has demonstrated that tiny pieces of human chromosome (with a known gene) can function in a mouse chromosome. When he puts the hybrid mouse-human chromosome into cells of a third species, Chinese hamster, genes of all three species are expressed. But if the mouse chromosome is lost from those cells, the product of the human gene also disappears. The scientists have not yet worked out the mechanisms underlying integration of one chromosome piece into another chromosome. Preliminary experiments suggest that at first several copies of the small piece go into the recipient cell, but only one copy becomes stably integrated into the recipient chromosome.

The new techniques are expected to reveal the detailed architecture of human chromosomes. Skill in introducing and maintaining pieces of DNA in recipient cells may also open the door to genetic therapy, Ruddle says. In addition, the procedures should increase biologists' opportunities for understanding the control mechanisms that govern which genes are active throughout an organism's life. □

Laetrile 'poisoning'

Researchers have reported perhaps the strongest suggestion yet that Laetrile (amygdalin) may be medically harmful. Janardan D. Khandekar and Harlan Edelman of Evanston (Ill.) Hospital and Northwestern University Medical School report that Laetrile dosage led to death in one-third to more than one-half of the rats they tested. The incidence of tumor enlargement and death — from apparent cyanide poisoning — increased with the size of the dose, they report in the July 13 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. The dosages ranged from 250 to 750 milligrams per kilogram per day for five days — "realistic in terms of human ingestion," say the researchers. □