reduce BOD loads. There are therefore no candidate technologies for more stringent BCT limits. If EPA had identified technologies that achieve greater TSS reductions than the proposed BPT, EPA would have performed the two part BCT cost test. (See 51 FR 24974 for a description of the methodology EPA employs when setting BCT standards.) EPA solicits comment on the assumptions it used in considering BCT.

EPA is proposing to establish BCT limits for conventional pollutants equivalent to the proposed BPT limits.

5. Best Available Technology Economically Achievable (BAT)

EPA is considering six technology options to control discharges from CAFOs in the beef, veal and poultry subcategories, and seven technology options for the dairy and hog subcategories. All of the technology options include restrictions on land application of manure, best management practices (BMPs), inspections and record keeping for the animal confinement areas, and wastewater storage or treatment structures. The following table summarizes the requirements for each of the seven technology options. Note that a given technology option may include a combination of technologies.

TABLE 8–1.—REQUIREMENTS CONSIDERED IN THE TECHNOLOGY OPTIONS

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Zero Discharge w/overflow when a 25–24 Design Standard is met	X	X	X	X	Cattle & Dairy	.....	.....
Depth markers for lagoons	X	X	X	X	Cattle & Dairy	X	X
Annual Manure Testing	X	X	X	X	X	X	X
N-based PNP	X	.....	.....	.....	.....	.....	.....
100' LA setback	X	X	X	X	X	X	X
P-based PNP (where necessary)	.....	X	X	X	X	X	X
Soil Test—every 3yrs.	.....	X	X	X	X	X	X
Zero discharge without any allowance for overflow	.....	.....	.....	.....	Swine & Poultry	.....	.....
Hydrologic Link Assessment & Zero Discharge to Groundwater beneath Production Area	.....	.....	X	X	.....	.....	.....
Ambient Surface Water Sampling (N,P,TSS)	.....	.....	.....	X	.....	.....	.....
Anaerobic Digestion w/power generation	.....	.....	.....	.....	Swine	Swine & Dairy	.....
Frozen/snow covered/saturated application prohibitions	.....	.....	.....	.....	.....	.....	X

X = All Subcategories.

Option 1. This option is equivalent to Option 1 described under BPT Section VIII.3. Option 1 would require zero discharge from the production area and that liquid storage be designed, constructed and maintained to handle all process wastewater and storm water runoff from the 25-year, 24-hour storm event. In addition, Option 1 requires management practices to ensure that the production area (which includes manure and wastewater storage) is being adequately maintained.

Option 1 also would establish a requirement to develop a PNP which establishes the proper land application rate for manure and wastewater to meet the nitrogen requirements for the crops being grown by the CAFO and require a 100 foot setback from surface water, sinkholes, tile drain inlets and agricultural drainage wells.

Option 2. This option is equivalent to Option 2 described under BPT (section VII.3). Option 2 includes all of the requirements established under Option 1. However, Option 2 would further restrict the amount of manure that can be applied to crop land owned or controlled by the CAFO. The CAFO would be required to apply manure and wastewater at the appropriate rate taking into account the nutrient requirements of the crop and soil conditions. Specifically, Option 2 would require that manure be applied at crop removal rate for phosphorus if soil conditions warrant and, if soils have a very high level phosphorus build-up, no manure or wastewater could be applied to the crop land owned or controlled by the CAFO.

Option 3. Option 3 includes all the requirements for Option 2 and would require that all operations perform an assessment to determine whether the ground water beneath the feedlot and manure storage area has a direct hydrological connection to surface water. As described in Section VII, EPA has authority to control discharges to surface water through ground water that has a direct hydrological connection to surface water. A hydrological connection refers to the interflow and exchange between surface impoundments and surface water through an underground corridor or ground water. EPA is relying on the permitting authority to establish the region-specific determination of what constitutes a direct hydrological link. Option 3 would require all CAFOs to determine whether they have a direct hydrological connection between the ground water beneath the production area and surface waters. If a link is established, the facility would have to monitor ground water up gradient and down gradient of the production area to ensure that they are achieving zero discharge to ground water. EPA has assumed that CAFOs would comply with the zero discharge requirement by installing liners of synthetic material beneath lagoons and ponds, and impervious pads below storage of dry manure stockpiles. EPA's costs for liners reflect both a synthetic liner and compacted clay to protect the liner and prolong its useful life.

CAFOs with a direct hydrologic link would be required to sample the groundwater from the monitoring wells (located up gradient and down gradient of the production area) at a minimum frequency of twice per year. These samples are necessary to ensure that pollutants are not being discharged through groundwater to surface water from the production area. The samples shall be monitored for nitrate, ammonia, total coliform, fecal coliform, Total Dissolved Solids (TDS) and total chloride. Differences in concentration of these pollutants between the monitoring

well(s) located up gradient and down gradient of the production area are assumed to represent a discharge of pollutants and must be prevented. As noted below, coliforms are not necessarily good indicators of livestock discharges. Also, it is difficult to determine ''concentrations'' of coliforms as they are not necessarily evenly distributed in the way chemical contaminants generally are. EPA requests comment on technical concerns associated with including total and fecal coliforms in the groundwater monitoring and protection requirements and on ways to address such concerns.

Option 4. Option 4 includes all the requirements for Option 3 and would require sampling of surface waters adjacent to feedlots and/or land under control of the feedlot to which manure is applied. This option would require CAFOs to sample surface water both upstream and downstream from the feedlot and land application areas following a one half inch rain fall (not to exceed 12 sample events per year). The samples would be analyzed for concentrations of nitrogen, phosphorus and total suspended solids (TSS). EPA selected these pollutants because it believes these pollutants provide an adequate indication of whether a discharge is occurring from the operation. All sampling results would be reported to the permit authority. Any difference in concentration between the upstream and downstream samples would be noted. This monitoring requirement could provide some indication of discharges from the land application or feedlot areas.

EPA also considered requiring that pathogens and BOD_5 be analyzed in samples collected. EPA decided that this would not be practical, because sampling under Option 4 is linked to storm events which limits the ability to plan in advance for analysis of the samples and making arrangements for shipping samples to laboratories. Fecal coliform and BOD samples all have very short holding times before they need to be analyzed. Most CAFOs are located in rural areas with limited access to overnight shipping services and are probably not near laboratories that can analyze for these pollutants. Further, fecal coliform and similar analytes that are typically used as indicators in municipal wastewater are not necessarily good indicators of livestock discharges. If CAFOs were required to monitor for pathogens which could indicate discharges of manure or CAFO wastewater, it would be better to require monitoring for fecal enterococci, or even specific pathogens such as salmonella, Giardia, and Cryptosporidium. However, the cost for analyzing these parameters is very high and the holding times for these parameters are also very short.

Furthermore, EPA determined pathogen analyses are also inappropriate because the pathogens in manure are found in areas without animal agriculture. For example Enterobacter, Klebsiella, Bacillus cereus, Clostridium, and Listeria are all naturally occurring soil and plant microorganisms and are found in soils that have never received manure. Pathogens may also be deposited onto land from wildlife. Thus, EPA concluded that requiring analysis for these pollutants was impractical at best and potentially very expensive.

Option 5. Option 5 includes the requirements established by Option 2 and would establish a zero discharge requirement from the production area that does not allow for an overflow under any circumstances. By keeping precipitation from contacting with the animals, raw materials, waste handling and storage areas, CAFOs could operate the confinement areas and meet zero discharge regardless of rainfall events. Option 5 includes the same land application requirements as Option 2, which would restrict the rate of manure and wastewater application to a crop removal rate for phosphorus where necessary depending on the specific soil conditions at the CAFO. Additionally, as in Option 2, application of manure and wastewater would be prohibited within 100 feet of surface water.

EPA considered Option 5 for the poultry, veal and hog subcategories, where it is common to keep the animals in total confinement, feed is generally maintained in enclosed hoppers and the manure and wastewater storage can be handled so as to prevent it from contacting storm water. EPA considered a number of ways a facility might meet the requirements of no discharge and no overflow. In estimating the costs associated with Option 5, EPA compared the total costs and selected the least expensive technology for a given farm size, geographic region, and manure management system. Costs also depend on whether the facility's PNP indicates land application must be based on nitrogen or phosphorus, and how many acres the facility controls. The technologies described below were used singularly or in combination to meet the requirements of Option 5.

Many facilities can achieve Option 5 by covering open manure and storage areas, and by constructing or modifying berms and diversions to control the flow of precipitation. EPA costed broiler and turkey operations for storage sheds sufficient to contain six months of storage. Some poultry facilities, particularly turkey facilities, compost used litter in the storage sheds, allowing recycle and reuse of the litter. EPA costed swine, veal, and poultry facilities which use lagoons or liquid impoundments for impoundment covers.

EPA believes that operations which have excess manure nutrients and use flush systems to move manure out of the confinement buildings will have an incentive to construct a second lagoon cell. A second storage or treatment cell should accomplish more decomposition of the waste and will allow flush water to be recycled out of the second cell or lagoon, thus reducing the addition of fresh water to the system. Reducing the total volume of stored waste reduces the risk of a catastrophic failure of the storage structure. In the absence of large volumes of water, facilities with an excess of manure nutrients will be able to transfer the excess manure off-site more economically due to a lower volume of waste needing to be hauled. Water reduction also results in a more concentrated product which would have a higher value as a fertilizer.

Covered systems substantially reduce air emissions, and help maintain the nutrient value of the manure. Covered systems also may benefit facilities by reducing odors emanating from open storage. This option also creates a strong incentive for facilities to utilize covered lagoon digesters or multistage covered systems for treatment. The use of covers will allow smaller and more stable liquid impoundments to be constructed. Finally, the use of covered impoundments encourages treatment and minimal holding times, resulting in pathogen die-off and reduction of BOD and volatile solids.

Other technologies can be effectively used at some facilities, such as conversion of flush systems to scrape systems, or by retrofit of slatted floor housing to V-shaped under house pits that facilitate solid liquid separation. Solids can be stored or composted in covered sheds, while the urine can be stored in small liquid impoundments.

In the event the facility has insufficient land to handle all nutrients generated, EPA evaluated additional nutrient management strategies. First, the manure could pass through solid separation, resulting in a smaller volume of more concentrated nutrients that is more effectively transported offsite. Second, land application could be based on the uppermost portion of a covered lagoon containing a more dilute concentration of nutrients. Data indicates much of the phosphorus

accumulates in the bottom sludge, which is periodically removed and could be transported offsite for proper land application. Though many facilities report sludge removal of a properly operating lagoon may occur as infrequently as every 20 years, EPA assumed facilities would pump out the phosphorus and metals enriched sludge every three years. This is consistent with the ANSI/ASAE standards for anaerobic treatment lagoons (EP403.3 JUL99) that indicates periodic sludge removal and liquid drawdown is necessary to maintain the treatment volume of the lagoon. Third, swine and poultry farms can implement a variety of feeding strategies, as discussed under Option 2 (see Section VII.C.3). Feed management including phytase, multistage diets, split sex feeding, and precision feeding have been shown to reduce phosphorus content in the manure by up to 50%. This results in less excess nutrients to be transported offsite, and allows for more manure to be land applied at the CAFO.

EPA is aware of a small number of swine facilities that are potentially CAFOs and use either open lots or some type of building with outside access to confine the animals. EPA data indicate these types of operations are generally smaller operations that would need to implement different technologies than those described above. CAFOs that provide outdoor access for the animals need to capture contaminated storm water that falls on these open areas. Open hog lots would find it difficult to comply with a requirement that does not allow for overflows in the event of a large storm. EPA costed these facilities to replace the open lots with hoop houses to confine the animals and storage sheds to contain the manure. Hoop structures are naturally ventilated structures with short wooden or concrete sidewalls and a canvas, synthetic, or reflective roof supported by tubes or trusses. The floor of the house is covered with straw or similar bedding materials. The manure and bedding is periodically removed and stored. The drier nature of the manure lends to treatment such as composting as well as demonstrating reduced hauling costs as compared to liquid manure handling systems.

EPA considered a variation to Option 5 that would require CAFOs to use dry or drier manure handling practices. This variation assumed conversion to a completely dry manure handling system for hogs and laying hens using liquid manure handling systems. In addition to the advantages of reduced water use described above, a completely dry system is more likely to minimize leaching to ground water and, where directly connected hydrologically to surface water, will also reduce loads to surface waters. For the beef and dairy subcategories EPA assumes that the liquid stream would be treated to remove the solids and the solids would be composted. It is not practical to assume beef and dairy operations can avoid the generation of liquid waste because operations in both subcategories tend to have animals in open areas exposed to precipitation resulting in a contaminated storm water that must be captured. Also dairies generate a liquid waste stream from the washing of the milking parlor.

Option 6. Option 6 includes the requirements of Option 2 and requires that large hog and dairy operations (hog operations and dairies with 2,000 AUs) would install and implement enclosed anaerobic digestion to treat their manure and use the captured methane gas for energy or heat generation. With proper management, such a system can be used to generate additional on-farm revenue. The enclosed system will reduce air emissions, especially odor and hydrogen sulfide, and potentially reduces nitrogen losses from ammonia volatilization. The treated effluent will also have less odor and should be more transportable relative to undigested manure, making offsite transfer of manure more economical. Anaerobic digestion under thermophilic or heated conditions would achieve additional pathogen reductions.

Option 7. Option 7 includes the requirements of Option 2 and would prohibit manure application to frozen, snow covered or saturated ground. This prohibition requires that CAFOs have adequate storage to hold manure for the period of time during which the ground is frozen or saturated. The necessary period of storage ranges from 45 to 270 days depending on the region. In practice, this may result in some facilities needing storage to hold manure and wastes for 12 months. EPA requests comment on whether there are specific conditions which warrant a national standard that prohibits application when the ground is frozen, snow covered or saturated.

6. Proposed Basis for BAT

BAT Requirements for the Beef and Dairy Subcategories. EPA is proposing to establish BAT requirements for the beef and dairy subcategories based on the same technology option. The beef subcategory includes stand-alone heifer operations and applies to all confined cattle operations except for operations that confine mature dairy cattle or veal. Under the two-tier structure, the BAT requirements would apply to any beef operation with 500 head of cattle or more. Under the three-tier structure, the BAT requirements for beef would apply to any operation with more than 1,000 head of cattle and any operation with 300 to 1,000 head which meets the conditions identified in section VII.B.2 and 3 of this preamble.

EPA proposes to establish BAT requirements for dairy operations which meet the following definitions: under the two-tier structure, all dairy with 350 head of mature dairy cows or more would be subject to today's proposed BAT requirements. Under the three-tier approach any dairy with more than 700 head of mature dairy cows or 250 to 700 head of mature dairy cows which meets the conditions identified in section VII of this preamble would be subject to today's proposed BAT requirements.

EPA proposes to establish BAT requirements for the beef and dairy subcategories based on Option 3. BAT would require all beef and dairy CAFOs to monitor the ground water beneath the production area by drilling wells up gradient and down gradient to measure for a plume of pollutants discharged to ground water at the production area. A beef or dairy CAFO can avoid this ground water monitoring by demonstrating, to the permit writer's satisfaction, that it does not have a direct hydrological connection between the ground water beneath the production area and surface waters.

EPA proposes to require CAFOs in the beef and dairy subcategories to monitor their ground water unless they determine that the production area is located above ground water which has a direct hydrological connection to surface water. CAFOs would have to monitor for ammonia, nitrate, fecal coliform, total coliform, total chlorides and TDS. EPA selected these pollutants because they may be indicators of livestock waste and are pollutants of concern to ground water sources. If the down gradient concentrations are higher than the up gradient concentration this indicates a discharge which must be controlled. As discussed above, EPA requests comment on the inclusion of total and fecal coliforms among the required analytes. For operations that do not demonstrate that they do not have a direct hydrologic connection, EPA based the BAT zero discharge requirement on the installation of liners in liquid storage structures such as lagoons and storm water retention ponds and concrete pads for the storage of dry manure stockpiles.

Beef and dairy CAFOs must also develop and implement a PNP that is based on application of manure and

wastewater to crop land either at a crop removal rate for phosphorus where soil conditions require it, or on the nitrogen requirements of the crop. EPA believes the land application rates established in accordance with one of the three methods described in today's proposed regulation, along with the prohibition of manure application within 100 feet of that surface water will ensure manure and wastewater are applied in a manner consistent with proper agricultural use. See EPA's document entitled ''Managing Manure Nutrients at Concentrated Animal Feeding Operations'' for the detailed discussion of how a PNP is developed.

EPA believes that technology option 3 is economically achievable and represents the best available technology for the beef and dairy subcategories, and is therefore proposing this option as BAT for these subcategories. The incremental annual cost of Option 3 relative to Option 2 for these subcategories is $170 million pre-tax under the two-tier structure, and $1205 million pre-tax under the three tier structure. EPA estimated annual ground water protection benefits from the proposed requirements of $70–80 million. EPA estimates Option 3 for the beef and dairy subcategories will reduce loadings to surface waters from hydrologically connected ground water by 3 million pounds of nitrogen. To determine economic achievability, EPA analyzed how many facilities would experience financial stress severe enough to make them vulnerable to closure under each regulatory option. As explained in more detail in the *Economic Analysis,* the number of facilities experiencing stress may indicate that an option might not be economically achievable, subject to additional considerations. Under Option 2, no facilities in either the beef or dairy sectors were found to experience stress, while under Option 3, the analysis projects 10 beef and 329 dairy CAFOs would experience stress under the two-tier structure, and 40 beef and 610 dairy CAFOs would experience stress under the three-tier structure. Of these, EPA has determined that 40 beef operations are considered small businesses based on size standards established by the Small Business Administration. This analysis assumes that 76% of affected operations would be able to demonstrate that their ground water does not have a hydrological connection to surface water and would therefore not be subject to the proposed requirements. EPA projects the cost of making this demonstration to the average CAFO would be $3,000. EPA is aware that concerns have been raised about these cost estimates, and about its estimates of how many facilities would be able to avoid the groundwater monitoring and protection requirements on this basis. EPA requests comment on this analysis and on its proposed determination that Option 3 is economically achievable for the beef and dairy sectors.

EPA is not proposing to base BAT requirements for the beef and dairy subcategories on Option 2 because it does not as comprehensively control discharges of pollutants through ground water which has a direct hydrological connection with surface water. However, EPA is requesting comment on Option 2 as a possible basis for BAT in the beef and dairy subcategories. EPA notes that even under Option 2, permit writers would be required to consider whether a facility is located in an area where its hydrogeology makes it likely that the ground water underlying the facility is hydrologically connected to surface water and whether a discharge to surface water from the facility through such hydrologically connected ground water may cause or contribute to a violation of State water quality standards. In cases where such a determination was made by the permit writer, he or she would impose appropriate conditions to prevent discharge via a hydrologic connection would be included in the permit. The main difference between Option 2 and Option 3 is thus that under Option 3, the burden of proof would be on the facility to demonstrate that it does not discharge to ground water that is hydrologically connected to surface water, while under Option 2, ground water protection and monitoring requirements would only be included in the permit if there were an affirmative determination by the permitting authority that such requirements were necessary to prevent a discharge of pollutants to surface waters via hydrologically connected ground water that may be sufficient to cause a violation of State water quality standards. Under today's proposal, the Option 2 approach to preventing discharges via hydrologically connected ground water would be used for the veal, swine and poultry subcategories. EPA requests comment on applying this approach to the beef and dairy subcategories as well.

EPA is not proposing to establish BAT requirements for the beef and dairy subcategories on the basis of Option 4 due to the additional cost associated with ambient stream monitoring and because the addition of in-stream monitoring does not by itself achieve any better controls on the discharges from CAFOs as compared to the other options. In-stream monitoring could be an indicator of discharges occurring from the CAFO; however, it is equally likely that in-stream monitoring will measure discharges that may be occurring from adjacent non-CAFO agricultural sources. Through the use of commercial fertilizers these non-CAFO sources would likely be contributing the same pollutants being analyzed under Option 4. EPA has not identified a better indicator parameter which would isolate constituents from CAFO manure and wastewater from other possible sources contributing pollutants to a stream. Pathogen analysis could be an indicator if adjacent operations do not also have livestock or are not using manure or biosolids as fertilizer sources. However, as described earlier, EPA has concerns about the ability of CAFOs to collect and analyze samples for these pollutants because of the holding time constraints associated with the analytical methods for these parameters. Accordingly, EPA does not believe that specifying these additional in-stream monitoring BMP requirements would be appropriate; and would not be useful in ensuring compliance with the Clean Water Act. Moreover, in-stream monitoring would be a very costly requirement for CAFOs to comply with.

EPA is not proposing to establish BAT requirements for the beef and dairy subcategories on the basis of Option 5. Option 5 would require zero discharge with no overflow from the production area. Most beef feedlots are open lots which have large areas from which storm water must be collected; thus, it is not possible to assume that the operation can design a storm water impoundment that will never experience an overflow even under the most extreme storm. Stand alone heifer operations (other than those that are pasture-based) are configured and operated in a manner very similar to beef feedlots. Unlike the hog, veal and poultry subcategories, EPA is not aware of any beef operations that keep all cattle confined under roof at all times.

Dairies also frequently keep animals in open areas for some period of time, whether it is simply the pathway from the barn to the milk house or an open exercise lot. Storm water from these open areas must be collected in addition to any storm water that contacts food or silage. As is the case for beef feedlots, the runoff volume from the exposed areas is a function of the size of the area where the cattle are maintained, and the amount of precipation. Since the CAFO operator cannot control the amount of precipation, there always remains the possibility that an extreme storm event

can produce enough rainfall that the resulting runoff would exceed the capacity of the lagoon.

EPA did consider a new source option for new dairies that would enforce total confinement of all cattle at the dairy. This new source option poses a barrier to entry for new sources, therefore, EPA assumes that this option if applied to existing sources would be economically unachievable. Furthermore, EPA did evaluate a variation of Option 5 that would apply to existing beef and dairy operations and would require the use of technologies which achieve a less wet manure. These technologies include solid-liquid separation and composting the solids. EPA is not proposing to establish BAT on the use of these technologies, but does believe these technologies may result in cost savings at some operations. Additionally, composting will achieve pathogen reductions. As described in section VIII.C.9., EPA is continuing to examine pathogen controls and may promulgate requirements on the discharge of pathogens. If EPA set limitations on pathogens, composting technology would likely become a basis for achieving BAT limits. EPA invites comment on composting and its application to dry beef and dairy manure.

For any operation that has inadequate crop land on which to apply its manure and wastewater, solid-liquid separation and composting could benefit the CAFO, as these technologies will make the manure more transportable. Drier manure is easier to transport; and therefore, EPA believes solid liquid separation and composting will be used in some situations to reduce the transportation cost of excess manure. In addition, composting is a value-added process that improves the physical characteristics (e.g., reduces odor and creates a more homogenous product) of the manure. It can also make the manure a more marketable product. As a result, a CAFO with excess manure may find it easier to give away, or even sell, its excess manure. EPA encourages all CAFOs to consider technologies that will reduce the volume of manure requiring storage and make the manure easier to transport.

Option 6, which requires anaerobic digestion treatment with methane capture, was not considered for the beef subcategory, but was considered for the dairy subcategory for treatment of liquid manure. Anaerobic digestion can only be applied to liquid waste. As described previously in Section VI, beef feedlots maintain a dry manure, yet they capture storm water runoff from the dry lot and manure stockpile. The storm water runoff is generally too dilute to apply digestion technology.

Most dairies, however, handle manure as a liquid or slurry which is suited to treatment through anaerobic digestion. EPA concluded that application of anaerobic digesters at dairies will not necessarily lead to significant reductions in the pollutants discharges to surface waters from CAFOs. An anaerobic digester does not eliminate the need for liquid impoundments to store dairy parlor water and barn flush water and to capture storm water runoff from the open areas at the dairy. Neither do digesters reduce the nutrients, nitrogen or phosphorus. Thus, basing BAT on digester technology would not change the performance standard that a production area at a CAFO would achieve and would not reduce or eliminate the need for proper land application of manure. Digesters were considered because they achieve some degree of waste stabilization and more importantly they capture air emissions generated during manure storage. The emission of ammonia from manure storage structures is a potentially significant contributor of nitrogen to surface waters. Covered anaerobic digesters will prevent these emissions while the waste is in the digester, but the digester does not convert the ammonia into another form of nitrogen, such as nitrate, which is not as volatile. Thus as soon as the manure is exposed to air the ammonia will be lost. Operations may consider additional management strategies for land application such as incorporation in order to maintain the nitrogen value as fertilizer and to reduce emissions.

As mentioned above, the application of ambient temperature or mesophilic anaerobic digesters would not change the performance standard that a CAFO would achieve. EPA considered anaerobic digestion as a means to control pathogens. Thermophilic digestion which applies heat to the waste will reduce pathogens. As described in Section VIII.C.9. EPA is still evaluating effective controls for pathogens.

EPA is not proposing to base BAT requirements on Option 7 for the beef and dairy subcategories. Option 7 would prohibit manure application on saturated, snow covered or frozen ground. Pollutant runoff associated with application of manure or wastewater to saturated, snow covered or frozen ground is a site specific consideration, and depends on a number of site specific variables, including distance to surface water and slope of the land. EPA believes that establishing a national standard that prohibits manure or wastewater application is inappropriate because of the site specific nature of these requirements and the regional variability across the nation. This is described in Section VII.E.5.b, above. However, Section VII also explains that EPA is proposing to revise 40 CFR Part 122 to require the permit authority to include, on a case-by-case basis, restrictions on the application of CAFO waste to frozen, snow covered or saturated ground in CAFO permits. This permit condition should account for topographic and climatic conditions found in the state.

Requirements for the beef and dairy subcategories would still allow for an overflow in the event of a chronic or catastrophic storm that exceeds the 25-year, 24-hour storm. EPA believes this standard reflects the best available technology. Under the proposed revisions to Part 122, permits will require that any discharge from the feedlot or confinement area be reported to the permitting authority within 24 hours of the discharge event. The CAFO operator must also report the amount of rainfall and the approximate duration of the storm event.

BAT Requirements for the Swine, Veal and Poultry Subcategories. EPA is proposing to establish BAT requirements for the swine, veal and poultry subcategories based on Option 5. For the purpose of simplifying this discussion, the term poultry is used to include chickens and turkeys. Option 5 requires zero discharge of manure and process wastewater and provides no overflow allowance for manure and wastewater storage. Land application requirements for these operations would be the same as the requirements under Option 2.

EPA is proposing Option 5 because swine, veal and poultry operations can house the animals under roof and feed is also not exposed to the weather. Thus, there is no opportunity for storm water contamination. Broiler and turkey operations generate a dry manure which can be kept covered either under a shed or with tarps. Laying hens with dry manure handling usually store manure below the birds' cages and inside the confinement building. Veal and poultry operations confine the animals under roof, thus there are no open animal confinement areas to generate contaminated storm water. Those operations with liquid manure storage can comply with the restrictions proposed under this option by diverting uncontaminated storm water away from the structure, and covering the lagoons or impoundments.

The technology basis for the poultry BAT requirements at the production

area are litter sheds for broiler and turkey CAFOs, and underhouse storage for laying hens with dry manure handling systems. For laying hen CAFOs with liquid manure handling systems, EPA's technology basis is solid separation and covered storage for the solids and covered lagoons.

Laying hen farms may also have egg wash water from in-line or off-line processing areas. Only 10% of laying hen operations with fewer than 100,000 birds have on farm egg processing, while 35% of laying hen operations with more than 100,000 birds have on farm egg processing. The wash water is often passed through a settling system to remove calcium, then stored in above ground tanks, below ground tanks, or lagoons. Today's proposal is based on covered storage of the egg wash water from on-farm processing, to prevent contact with precipitation. The ultimate disposal of egg wash water is through land application which must be done in accordance with the land application rates established in the PNP. EPA believes the low nutrient value of egg washwater is unlikely to cause additional incremental costs to laying hen facilities to comply with the proposed land application requirements.

EPA assumes large swine operations (e.g., operations with more than 1,250 hogs weighing 55 pounds or greater) operate using total confinement practices. EPA based BAT Option 5 on the same approach described above of covering liquid manure storage. CAFOs can operate covered lagoons as anaerobic digesters which is an effective technology for achieving zero discharge and will provide the added benefits of waste stabilization, odor reduction and control of air emissions from manure storage structures. Anaerobic digesters also can be operated to generate electricity which can be used by the CAFO to offset operating costs.

Although Option 5 is the most expensive option for the hog subcategory, as shown on Table X.E.2(a), EPA believes this option reflects best available technology economically achievable because it prevents discharges resulting from liquid manure overflows that occur in open lagoons and pond. Similarly, the technology basis of covered treatment lagoons and drier manure storage is believed to reduce the likelihood of those catastrophic lagoon failures associated with heavy rainfalls. Option 5 also achieves the greatest level of pollutant reductions from runoff reaching the edge of the field. Non-water quality environmental impacts include reduced emissions and odor, with a concurrent increase in nitrogen value of the manure, however as mentioned previously, the ammonia concentration is not reduced and once the manure is exposed to air the ammonia will volatilize. Water conservation and recycling practices associated with Option 5 will promote increased nutrient value of the manure, reduced hauling costs via reduced water content, and less fresh water use.

The technology basis of Option 5, solid-liquid separation and storage of the solids, has the advantage of creating a solid fraction which is more transportable, thus hog CAFOs that have excess manure can use this technology to reduce the transportation costs.

EPA is aware of three open lot hog operations that have more than 1,250 hogs and there may be a small number of others, but the predominant practice is to house the animals in roofed buildings with total confinement. For open lot hog CAFOs, EPA is proposing to base BAT the application of hoop structures as described above.

Veal operations use liquid manure management and store manure in lagoons. EPA has based BAT on covered manure and feed storage. The animals are housed in buildings with no outside access. Thus, by covering feed and waste storage the need to capture contaminated storm water is avoided.

In evaluating the economic achievability of Option 5 for the swine, veal and poultry subcategories, EPA evaluated the costs and impacts of this option relative to Option 2. For these subcategories, the incremental annual cost of Option 5 over Option 2 would be $110 million pre-tax under the two-tier structure, and $140 million pre-tax under the three-tier structure. Almost all of these incremental costs are projected to be in the swine sector. Since the majority of the costs are borne by the swine subcategory, EPA solicits comment on establishing BAT on the basis Option 5 for the only the veal and poultry subcategories, and establishing BAT on the basis of Option 2 that the swine subcategory. EPA projects that there would be no additional costs under the two-tier structure, and only very small additional costs under the three-tier structure for the veal and poultry subcategories to move from Option 2 to Option 5. Under Option 2, EPA estimates 300 swine operations and 150 broiler operations would experience stress under the two-tier structure, and 300 swine operations and 330 broiler operations would experience stress under the three-tier structure. Under Option 5 an additional 1,120 swine operations would experience stress under both the two-tier and three-tier structures. All affected hog operations have more than 1000 AU. None of these affected hog operations are small businesses based on the Small Business Administration's size standards. There would be no additional broiler operations experiencing stress under Option 5, and no veal, layer, or turkey operations are projected to experience stress under either Option 2 or Option 5. EPA did not analyze the benefits of Option 5 relative to Option 2. Under Option 2 operations are required to be designed, constructed and operated to contain all process generated waste waters, plus the runoff from a 25-year, 24-hour rainfall event for the location of the point source. Thus, the benefit of Option 5 over Option 2 would be the value of eliminating discharges during chronic or catastrophic rainfall events of a magnitude of the 25-year, 24-hour rainfall event or greater. Further benefit would be realized as a result of increased flexibility on the timing of manure application to land. By preventing the rainfall and run-off from mixing with wastewater, CAFOs would not need to operate such that land application during storm events was necessary.

EPA is not proposing Option 2 for these sectors. However, EPA notes that at the time of the SBREFA outreach process, removing the 25-year, 24-hour design standard for any sector was not considered largely due to concern that a different design standard would lead to larger lagoons or impoundments. EPA staff explicitly stated this to the SERs and other member of the Panel. Although not extensively discussed, since it did not appear at that time to be an issue, retention of this standard was supported by both the SERs and the Panel. At that time, EPA was not planning to evaluate such an option because of the concern that this would encourage larger lagoons. Since the Panel concluded it outreach, EPA decided to evaluate, and ultimately propose removing this design standard for the veal, swine and poultry subcategories because of reports of lagoon failures resulting from rainfall and poor management. As mentioned previously, all of these sectors maintain their animals under roof eliminating the need to capture contaminated storm water from the animal confinement area. In addition, most poultry operations generate a dry manure, which when properly stored, under some type of cover, eliminates any possibility of an overflow in the event of a large storm. Therefore EPA believes that Option 5 technology which prevents the introduction of storm water into manure

storage is achievable and represents Best Available Technology, without redesigning the capacity of existing manure storage units. However, EPA requests comment on retaining te 25-year, 24-hour storm design standard (and thus basing BAT on Option 2) for these sectors, consistent with its intention at the time of the SBREFA outreach process.

EPA is not proposing to base BAT for the swine, poultry and veal subcategories on Option 3, because EPA believes Option 5 is more protective of the environment. If operators move towards dry manure handling technologies and practices to comply with Option 5, there should be less opportunity for ground water contamination and surface water contamination through a direct hydrological connection. EPA strongly encourages any newly constructed lagoons or anaerobic digesters to be done in such a manner as to minimize pollutant losses to ground water. A treatment lagoon should be lined with clay or synthetic liner or both and solid storage should be on a concrete pad or preferably a glass-lined steel tank as EPA has included in its estimates of BAT costs. Additionally, Option 5 provides the additional non-water quality benefit of achieving reductions in air emissions from liquid storage systems. EPA estimates that the cost of complying with both Option 3 and 5 at existing facilities would be economically unachievable.

EPA believes the proposed technology basis for broilers, turkeys and laying hens with dry manure management will avoid discharges to ground water since the manure is dry and stored in such a way as to prevent storm water from reaching it. Without some liquid to provide a transport mechanism, pollutants cannot move through the soil profile and reach the ground water and surface water through a direct hydrological connection.

EPA is not proposing to base BAT on Option 4 for the same reasons described above for the beef and dairy subcategories.

EPA is not proposing to base BAT on Option 6, because EPA believes that the zero discharge aspect of the selected option will encourage operations to consider and install anaerobic digestion in situations where it will be cost effective.

As with beef and dairy, EPA is not proposing to base BAT for swine, veal and poultry on Option 7, but believes that permit authorities should establish restrictions as necessary in permits issued to CAFOs. Swine, veal and poultry operations should take the timing of manure application into account when developing the PNP. Any areas that could result in pollutant discharge from application of manure to frozen, snow covered or saturated ground should be identified in the plan and manure or wastewater should not be applied to those areas when there is a risk of discharge.

EPA solicits comment on the use of remote liquid level monitoring at livestock operations. As described above in Section VIII.C.3, this technology could provide advanced notification that levels are reaching a critical point, and corrective actions could then be taken. This technology does not prevent precipitation from entering the lagoon and does not prevent overflows, therefore EPA chose not to propose this technology as BAT for swine or veal operations. However, EPA solicits comments on applicability of this technology to livestock operations, especially at swine and veal as an alternative to covers on lagoons.

PNP Requirements

There are a number of elements that are addressed by both USDA's ''Guidance for Comprehensive Nutrient Management Plans (CNMPs)'' and EPA's PNP which would be required by the effluent guidelines and NPDES proposed rules and is detailed in the guidance document ''Managing Manure Nutrients at Concentrated Animal Feeding Operations.'' EPA's proposed PNP would establish requirements for CAFOs that are consistent with the technical guidance published by USDA experts, but go beyond that guidance by identifying specific management practices that must be implemented. What follows is a brief description of what must be included in a PNP.

General Information. The PNP must have a Cover Sheet which contains the name and location of the operation, the name and title of the owner or operator and the name and title of the person who prepared the plan. The date (month, day, year) the plan was developed and amended must be clearly indicated on the Cover Sheet. The Executive Summary would briefly describe the operation in terms of herd or flock size, total animal waste produced annually, crop identity for the full 5 year period including a description of the expected crop rotation and, realistic yield goal. The Executive Summary must include indication of the field conditions for each field unit resulting from the phosphorus method used (e.g., phosphorus index), animal waste application rates, the total number of acres that will receive manure, nutrient content of manure and amount of manure that will be shipped off-site. It should also identify the manure collection, handling, storage, and treatment practices, for example animals kept on bedding which is stored in a shed after removal from confinement house, or animals on slatted floors over a shallow pull plug pit that is drained to an outdoor in-ground slurry storage inpoundment. Finally, the Executive Summary would have to identify the watershed(s) in which the fields receiving manure are located or the nearest surface water body. While the General Information section of a PNP would give a general overview of the CAFO and its nutrient management plan, subsequent sections would provide further detail.

Animal Waste Production. This subsection details types and quantities of animal waste produced along with manure nutrient sampling techniques and results. Information would be included on the maximum number of livestock ever confined and the maximum livestock capacity of the CAFO, in addition to the annual livestock production. This section would provide an estimate of the amount of animal waste collected each year. Each different animal waste source should be sampled annually and tested by an accredited laboratory for nitrogen, phosphorous, potassium, and pH.

Animal Waste Handling, Collection, Storage, and Treatment. This subsection details best management practices to protect surface and groundwater from contamination during the handling, collection, storage, and treatment of animal waste. A review would have to be conducted of potential water contamination sources from existing animal waste handling, collection, storage, and treatment practices. The capacity needed for storage would be calculated.

Feedlot runoff would have to be contained and adequately managed. Runoff diversion structures and animal waste storage structures would have to be visually inspected for: seepage, erosion, vegetation, animal access, reduced freeboard, and functioning rain gauges and irrigation equipment, on a weekly basis. Deficiencies based on visual inspections would have to be identified and corrected within a reasonable time frame. Depth markers would have to be permanently installed in all lagoons, ponds, and tanks. Lagoons, ponds, and tanks would have to be maintained to retain capacity for the 25-year, 24-hour storm event. Dead animals, required to be kept out of lagoons, would have to be properly handled and disposed of in a timely

manner. Finally, an emergency response plan for animal waste spills and releases would have to be developed.

Land Application Sites. This subsection details field identification and soil sampling. County(ies) and watershed code(s) where feedlot and land receiving animal waste applications are located would be identified. Total acres of operation under the control of the CAFO (owned and rented) and total acres where animal waste will be applied would be included. A detailed farm map or aerial photo, to be included, would have to indicate: location and boundaries of the operation, individual field boundaries, field identification and acreage, soil types and slopes, and the location of nearby surface waters and other environmentally sensitive areas (e.g., wetlands, sinkholes, agricultural drainage wells, and aboveground tile drain intakes) where animal waste application is restricted.

Separate soil sampling, using an approved method, would have to be conducted every 3 years on each field receiving animal waste. The samples shall be analyzed at an accredited laboratory for total phosphorous. Finally, the phosphorous site rating for each field would have to be recorded according to the selected assessment tool.

Land Application. This subsection details crop production and animal waste application to crop production areas. Details of crop production would have to include: Identification of all planned crops, expected crop yields and the basis for yield estimates, crop planting and harvesting dates, crop residue management practices, and nutrient requirements of the crops to be grown. Calculations used to develop the application rate, including nitrogen credits from legume crops, available nutrients from past animal waste applications, and nutrient credits from other fertilizer and/or biosolids applications would have to be included.

Animal waste application rates cannot exceed nitrogen requirements of the crops. However, animal waste application rates would be limited to the agronomic requirements for phosphorous if the soil phosphorous tests are rated ''high'', the soil phosphorous tests are equal to ¾, but not greater than twice the soil phosphorous threshold value, or the Phosphorous Index rating is ''high.'' Finally, animal waste could not be applied to land if the soil phosphorous tests are rated ''very high'', the soil phosphorous tests are greater than twice the soil phosphorous threshold value, or the Phosphorous Index rating is ''very high.'' In some cases, operators may choose to further restrict application rates to account for other limiting factors such as salinity or pH.

Animal wastes cannot be applied to wetlands or surface waters, within 100 feet of a sinkhole, or within 100 feet of water sources such as rivers, streams, lakes, ponds, and intakes to agricultural drainage systems (e.g., aboveground tile drain intakes, agricultural drainage wells, pipe outlet terraces). EPA requests comment on how serious would be the limitations imposed by these requirements. Manure spreader and irrigation equipment would have to be calibrated at a minimum once each year, but preferably before each application period. Finally, the date of animal waste application and calibration application equipment, and rainfall amounts 24-hours before and after application would be recorded.

Other Uses/Off-Site Transfer. The final required subsection for a PNP details any alternative uses and off-site transport of animal wastes. If used, a complete description of alternative uses of animal waste would have to be included. If animal wastes are transported off-site the following would have to be recorded: date (day, month, year), quantity, and name and location of the recipient of the animal waste.

Voluntary Measures. Many voluntary best management practices can be included within various subsections of a PNP. These voluntary best management plans are referenced in EPA's guidance document for PNP ''Managing Manure Nutrients at Concentrated Animal Feeding Operations.''

Annual Review and Revision. While a PNP is required to be renewed every 5 years (coinciding with NPDES permitting), an annual review of the PNP would have to occur and the PNP would be revised or amended as necessary.

The most likely factor which would necessitate an amendment or revision to a PNP is a change in the number of animals at the CAFO. A substantial increase in animal numbers (for example an increase of greater than 20%) would significantly increase the volume of manure and total nitrogen and phosphorous produced on the CAFO. Because of this, the CAFO will need to re-evaluate animal waste storage facilities to ensure adequate capacity, and may need to re-examine the land application sites and rates.

A second reason which would require an amendment or revision to a PNP is a change in the cropping program which would significantly alter land application of animal waste. Changes in crop rotation or crop acreage could significantly alter land application rates for fields receiving animal waste. Also the elimination or addition of fields receiving animal waste application would require a change in the PNP.

Changes in animal waste collection, storage facilities, treatment, or land application method would require an amendment or revision to a PNP. For example, the addition of a solid-liquid separator would change the nutrient content of the various animal waste fractions and the method of land application thereby necessitating a revision in a PNP. Changing from surface application to soil injection would alter ammonia volatilization subsequently altering animal waste nutrient composition requiring a revision of land application rates.

When CAFOs Must Have PNPs. EPA proposes to allow two groups of CAFOs up to 90 days to obtain a PNP:

3. Existing CAFOs which are being covered by a NPDES permit for the first time; or

4. Existing CAFOs that are already covered under an existing permit which is reissued within 3 years from the date of promulgation of these regulations.

EPA proposes that all other existing CAFOs must have a PNP at the time permits are issued or renewed.

7. New Source Performance Standards

For purposes of applying the new source performance standards (NSPS) being proposed today, a source would be a new source if it commences construction after the effective date of the forthcoming final rule. (EPA expects to take final action on this proposal in December 2002, which is more than 120 days after the date of proposal—see 40 CFR 122.2). Each source that meets this definition would be required to achieve any newly promulgated NSPS upon commencing discharge.

In addition, EPA is proposing additional criteria to define ''new source'' that would apply specifically to CAFOs under Part 412. EPA intends that permit writers will consult the specific ''new source'' criteria in Part 412 rather than the more general criteria set forth in 40 CFR 122.29(b)(1). The other provisions of 40 CFR 122.29 continue to apply. EPA proposes to consider an operation as a new source if any of the following three criteria apply.

The definition of new source being proposed for Part 412 states three criteria that determine whether a source is a ''new source.''

First, a facility would be a new source if it is constructed at a site at which no other source is located. These new sources have the advantage of not

having to retrofit the operation to comply with BAT requirements, and thus can design to comply with more stringent and protective requirements.

The second criterion for defining a new source would be where new construction at the facility ''replaces the housing, waste handling system, production process, or production equipment that causes the discharge or potential to discharge pollutants at an existing source.'' Confinement housing and barns are periodically replaced, allowing the opportunity to install improved systems that provide increased environmental protection. The modern confinement housing used at many swine, dairy, veal, and poultry farms allows for waste handling and storage in a fashion that generates little or no process water. Such systems negate the need for traditional flush systems and storage lagoons, reduce the risks of uncontrollable spills, and decrease the costs of transporting manure.

Third, a source would be a new source if construction is begun after the date this rule is promulgated and its production area and processes are substantially independent of an existing source at the same site. Facilities may construct additional production areas that are located on one contiguous property, without sharing waste management systems or commingling waste streams. Separate production areas may also be constructed to help control biosecurity. New production areas may also be constructed for entirely different animal types, in which case the more stringent NSPS requirements for that subcategory would apply to the separate and newly constructed production area. In determining whether production and processes are substantially independent, the permit authority is directed to consider such factors as the extent to which the new production areas are integrated with the existing production areas, and the extent to which the new operation is engaging in the same general type of activity as the existing source.

EPA also considered whether a certain level of facility expansion, measured as an increase in animal production, should cause an operation to be subject to new source performance standards. If so, upon facility expansion, the CAFO would need to go beyond compliance with BAT requirements to meet the more stringent standards represented by NSPS. In today's proposal, that increment of additional control, for the swine, poultry and veal subcategories, would amount to the need to monitor ground water and install liners in lagoons and impoundments to prevent discharges to ground water that has a direct hydrological connection to surface water; unless the CAFO could demonstrate that no such direct hydrological link existed. In the beef and dairy subcategories, the NSPS proposed today are the same as the BAT standards.

The Agency, however, decided against proposing to identify facility expansion as a trigger for the application of NSPS. Many CAFOs oversize or over-engineer their waste handling systems to accommodate future increases in production. Thus, in many cases, the actual increases in production may not present a new opportunity for the CAFO to install the additional NSPS technologies—e.g. liners. To install liners, these operations would need to retrofit their facilities the same as existing sources would. EPA has explained above that such retrofitting would not be economically achievable in these animal sectors. Similarly, the costs associated with these requirements would represent a barrier to the expansion. Therefore, it would not be appropriate to require these operations, upon facility expansion, to meet the additional ground water-related requirements that are a part of today's proposed NSPS.

EPA considered the same seven options for new source performance standards (NSPS) as it considered for BAT. EPA also considered an additional option for new dairies, which if selected, would prohibit dairies from discharging any manure or process wastewater from animal confinement and manure storage areas (i.e., eliminating the allowance for discharging overflows associated with a storm event). New sources have the advantage of not having to retrofit the operation to comply with the requirements and thus can design the operation to comply with more stringent requirements. In selecting new source performance standards, EPA evaluates whether the requirements under consideration would impose a barrier to entry to new operations.

EPA is proposing to select Option 3 as the basis for NSPS for the beef and dairy subcategories. Option 3 includes all the requirements proposed for existing sources including complying with zero discharge from the production area except in the event of a 25-year, 24-hour storm and the requirement to develop a PNP which establishes the rate at which manure and wastewater can be applied to crop or pasture land owned or controlled by the CAFO. The application of manure and wastewater would be restricted to a phosphorus based rate where necessary depending on the specific soil conditions at the CAFO. Additionally, other best management practice requirements would apply, including the prohibition of manure and wastewater application within 100 feet of surface water. The proposed new source standard for the beef and dairy subcategories includes a requirement for assessing whether the ground water beneath the production area has a direct hydrological connection to surface water. If a direct hydrological connection exists, the operation must conduct additional monitoring of ground water up gradient and down gradient from the production area, and implement any necessary controls based on the monitoring results to ensure that zero discharge to surface water via the ground water route is achieved for manure stockpiles and liquid impoundments or lagoons. For the purpose of estimating compliance costs, EPA has assumed that operations located in areas with a direct hydrological connection will install synthetic material or compacted clay liners beneath any liquid manure storage and construct impervious pads for any dry manure storage areas. The operator would be required to collect and analyze ground water samples twice per year for total dissolved solids, chlorides, nitrate, ammonia, total coliforms and fecal coliform. EPA believes that Option 3 is economically achievable for existing sources. Since new sources are able to install impermeable liners at the time the lagoon or impoundment is being constructed, rather than retrofitting impoundments at existing source, costs associated with this requirement should be less for new sources in comparison to existing sources. EPA has concluded that Option 3 requirements will not pose a barrier to entry for new sources.

EPA is proposing to establish NSPS for all swine and poultry operations based on Option 5 and Option 3 combined. In addition the BAT requirements described in Section VIII.C.6, the proposed new source standards would require no discharge via any ground water that has a direct hydrological link to surface water. As described above, Option 3 requires all CAFOs to monitor the ground water and impose appropriate controls to ensure compliance with the zero discharge standard, unless the CAFO has demonstrated that there is no direct hydrological link between the ground water and any surface waters. The proposed new source standard also restricts land application of manure and

wastewater to a phosphorus based rate where necessary depending on the specific soil conditions at the CAFO. Additionally, other best management practice requirements would apply, including that application of manure and wastewater would be prohibited within 100 feet of surface water.

EPA encourages new swine and poultry facilities to be constructed to use dry manure handling. Dry manure handling is currently the standard practice at broiler and turkey operations. As described previously, some existing laying hen operations and most hog operations use liquid manure handling systems. The proposed new source performance standard would not require the use of dry manure handling technologies, but EPA believes this is the most efficient technology to comply with its requirements.

EPA has analyzed costs of installing dry manure handling at new laying hen and swine operations. Both sectors have operations which demonstrate dry manure handling can be used as an effective manure management system. The dry manure handling systems considered for both sectors require that the housing for the animals be constructed in a certain fashion, thus making this practice less practical for existing sources. Both sectors have developed a high rise housing system, which houses the animals on the second floor of the building allowing the manure to drop to the first floor or pit. In the laying hen sector this is currently a common practice and with aggressive ventilation, the manure can be maintained as a dry product. Hog manure has a lower solids content, thus the manure must be mixed with a bedding material (*e.g.,* wood chips, rice or peanut hulls and other types of bedding) which will absorb the liquid. To further aid in drying the hog manure, air is forced up through pipes installed in the concrete floor of the pit. With some management on the part of the CAFO operator, involving mixing and turning the hog manure in the pit periodically, the manure can be composted while it is being stored. The advantages of the high rise system for hogs and laying hens include a more transportable manure, which, in the case of the hog high rise system, has also achieved a fairly thorough decomposition. The air quality inside the high rise house is greatly improved, and the potential for leaching pollutants into the groundwater is greatly reduced. The design standard of these high rise houses include concrete floors and also assume that the manure would be retained in the building until it will be land applied, thus there is no opportunity for storm water to reach the manure storage and virtually no opportunity for pollutants to leach to groundwater beneath the confinement house. EPA believes that the cost savings associated with ease of manure transportation, as well as improved animal health and performance, with the dry manure handling system for hogs will off-set the increased cost of operation and maintenance associated with the high rise hog system. Thus, EPA concludes the high-rise house does not pose a barrier to entry and is the basis for NSPS in both the laying hen and hog sectors. Although the high rise house is the basis of the new source standards for the swine and laying hen sectors, operations are not prevented from constructing a liquid manure handling system. If new sources in these sectors choose to construct a liquid manure handling system, they would be required to line the lagoons if the operation is located in an area that has a direct hydrologic connection, but the cost associated with lining a lagoon at the time it is being constructed is much less than the cost to retrofit lagoon liners.

EPA proposes to establish new source requirements for the veal subcategory on the basis of Option 5 which requires zero discharge with no overflow from the production area and Option 3 which requires zero discharge of pollutants to groundwater which has a direct hydrological connection to surface water, with the ground water monitoring or hydrological assessment requirements described above. EPA believes that a zero discharge standard without any overflow will promote the use of covered lagoons, anaerobic digesters or other types of manure treatment systems. Additionally, this will minimize the use of open air manure storage systems, thus reducing emission of pollutants from CAFOs.

New veal CAFOs would not be expected to modify existing housing conditions since EPA is not aware of any existing veal operations that use dry manure handling systems. New veal CAFOs would be expected to also use covered lagoons, or anaerobic digesters to comply with the zero discharge standard. New veal CAFOs would be required to line their liquid manure treatment or storage structures with either synthetic material or compacted clay to prevent the discharge of pollutants to ground water which has a direct hydrological connection to surface water. In addition, the CAFO would have to monitor the groundwater beneath the production area to ensure compliance with the zero discharge requirement. The CAFO would not need to install liners or monitor ground water if it demonstrates that there is no direct hydrologic link between the ground water and any surface waters.

In addition to the seven options considered for both existing and new sources, EPA also investigated a new source option for dairies that would prohibit all discharges of manure and process wastewater to surface waters, eliminating the current allowance for the discharge of the overflow of runoff from the production area. To comply with a zero discharge requirement, dairies would need to transform the operation so they could have full control over the amount of manure and wastewater, including any runoff, entering impoundments. Many dairies have drylot areas where calves, heifers, and bulls are confined, as well as similar drylot areas where the mature cows are allowed access. EPA estimated compliance costs for a zero discharge requirements assuming that the following changes would occur at new dairies:

(1) Freestall barns for mature cows would be constructed with six months underpit manure storage, rather than typical flush systems with lagoon storage;

(2) Freestall barns with six months underpit manure storage would be constructed to house heifers;

(3) Calf barns with a scrape system would be constructed with a scrape system and six months of adjacent manure storage; and

(4) New dairies would include covered walkways, exercise areas, parlor holding, and handling areas.

Drylot areas are continually exposed to precipitation. The amount of contaminated runoff from such areas that must be captured is directly related to the size of the exposed area and the amount of precipitation. Under the current regulations, dairies use the 25-year, 24-hour rainfall event (in addition to other considerations) when determining the necessary storage capacity for a facility. Imposing a zero discharge requirement that prevents any discharge from impoundments would force dairies to reconfigure in a way that provides complete control over all sources of wastewater. EPA considered the structural changes in dairy design described here to create a facility that eliminates the potential for contaminated runoff.

While EPA believes that confining all mature and immature dairy cattle is technically feasible, the costs of zero discharge relative to the costs for Option 3 are very high. Capital costs to comply with zero discharge increase by two orders of magnitude. EPA estimates

annual operating and maintenance costs would rise between one to two orders of magnitude above the costs for Option 3. These costs may create a barrier to entry for new sources. In addition, EPA believes selecting this option could have the unintended consequence of encouraging dairies to shift calves and heifers offsite to standalone heifer raising operations (either on land owned by the dairy or at contract operations) to avoid building calf and heifer barns. If these offsite calf/heifer operations are of a size that they avoid being defined as a CAFO, the manure from the immature animals would not be subject to the effluent guidelines.

EPA is not basing requirements for new dairies on the zero discharge option for the reasons discussed above. EPA solicits comment on the approach used to estimate the costs for new dairies to comply with a zero discharge requirement. Comments are particularly solicited on aspects such as: converting from flush systems to underpit manure storage; types of housing for calves and heifers; and whether the potential for uncontrollable amounts of precipitation runoff have been sufficiently eliminated (including from silage). EPA also solicits comment on a regulatory scenario that would establish a zero discharge requirement for manure and process wastewater from barns (housing either mature or immature dairy cattle) and the milking parlor, but would maintain the current allowance for overflow of runoff from drylot areas.

As an alternative to underpit manure storage, dairies could achieve zero discharge for parlor wastes and barn flush water by constructing systems such as anaerobic digesters and covered lagoons. These covered systems, if properly operated, can facilitate treatment of the manure and offer opportunities to reduce air emissions. The resulting liquid and solid wastes would be more stable than untreated manure. EPA solicits comment on the usefulness of applying stabilization or treatment standards to liquid and slurry manures prior to land application. Commenters encouraging the use of such standards should recommend appropriate measurement parameters such as volatile solids, BOD, COD, and indicator organism reduction(s) to establish stability or treatment levels.

EPA has not identified any basis for rejecting the zero discharge option for dairies solely due to animal health reasons. EPA solicits comment on the technical feasibility of confining mature and/or immature dairy cattle in barns at all times.

Ten-year protection period. The NSPS that are currently codified in part 412 will continue to have force and effect for a limited universe of CAFOs. For this reason, EPA is proposing to retain the NSPS promulgated in 1974 for part 412. Specifically, following promulgation of the final rule that revises part 412, the 1974 NSPS would continue to apply for a limited period of time to certain new sources and new dischargers. See CWA section 306(d) and 40 CFR 122.29(d). Thus, if EPA promulgates revised NSPS for part 412 in December 2002, and those regulations take effect in January 2003, qualified new sources and new dischargers that commenced discharge after January 1993 but before January 2003 would be subject to the currently codified NSPS for ten years from the date they commenced discharge or until the end of the period of depreciation or amortization of their facility, whichever comes first. See CWA section 306(d) and 40 CFR 122.29(d). After that ten year period expires, any new or revised BAT limitations would apply with respect to toxic and nonconventional pollutants. Limitations on conventional pollutants would be based on the1974 NSPS unless EPA promulgates revisions to BPT/BCT for conventional pollutants that are more stringent than the 1974 NSPS.

Rather than reproduce the 1974 NSPS in the proposed rule, EPA proposes to refer permitting authorities to the NSPS codified in the 2000 edition of the Code of Federal Regulations for use during the applicable ten-year period.

8. Pretreatment Standards for New or Existing Sources (PSES AND PSNS)

EPA is not proposing to establish Pretreatment Standards for either new or existing sources. Further, EPA is withdrawing the existing provisions entitled ''Pretreatment standards for existing sources'' at §§ 412.14, 412.16, 412.24, 412.26. Those existing provisions establish no limitations. The vast majority of CAFOs are located in rural areas that do not have access to municipal treatment systems. EPA is not aware of any existing CAFOs that discharge wastewater to POTWs at present and does not expect new sources to be constructed in areas where POTW access will be available. For those reasons, EPA is not establishing national pretreatment standards. However, EPA also wants to make it clear that if a CAFO discharged wastewater to a POTW, local pretreatment limitations could be established by the Control Authority. These local limits are similar to BPJ requirements in an NPDES permit.

9. Effluent Guidelines Controls for Pathogens

The third most common reason for waterbodies being listed on State § 303(d) lists as an impaired watershed is pathogens. Degradation of surface waters by excessive levels of pathogens has been attributed to several sources, including natural wildlife, faulty septic systems, and animal agriculture. As described in Section 5, stream water quality may be impacted by animal feeding operations due to feedlot surface runoff, spills from liquid impoundments, tile drain effluent, leaching and runoff from land receiving manure, and seepage from waste storage. Degradation of aquatic and riparian habitat also occurs when animal grazing operations are poorly managed.

In today's notice, EPA is not setting specific requirements for the control of pathogens. The proposed BAT is expected to reduce pathogens to surface waters through the implementation of the zero discharge requirements at the production area, and through the implementation of the PNP at the land application area. Even without explicit requirements or limits for pathogen controls, EPA expects considerable reduction in the discharge of pathogens for reasons described below. Runoff simulations and loadings analysis predict a 50% reduction in fecal coliforms and a 60% reduction in fecal streptococci under the regulatory scenario proposed today. Following this proposal, EPA intends to further analyze technologies for the treatment or reduction of pathogens in manure, and solicits comment on other approaches to control pathogens.

One mechanism for pathogen discharge to surface waters is catastrophic spills, whether caused by intentional discharges or through overflow following major storms. EPA expects the requirements for no discharge from the production area, as well as routine inspection and mandatory management practices for the control of liquid impoundment levels, will reduce catastrophic spills. For the swine and poultry sectors EPA believes the elimination of the storm event at which an overflow is allowed will also reduce discharge of pathogens. At the production area, operators would be required to handle animal mortalities in a manner so as to prevent contamination of surface water. The proper use of manure as a fertilizer, as specified in the proposed regulations, may result in increased storage capacity and longer retention times of both liquid and solid manure storage, allowing

increased opportunity for natural die-off of pathogens. For example, runoff from fields receiving poultry litter that had been stored prior to application showed no significant difference in pathogen content in runoff from control fields (GEIS, 1999), supporting the conclusion that pathogen reductions will occur from increased storage times.

Application rate has been identified as the single most important manure management practice affecting pollution of surface waters from fields receiving manure. Other practices affecting pathogen content in the runoff include amount of application, incorporation methods, tillage, saturation of the receiving field, and elapsed time following application before a rainfall. In one case study, swine lagoon effluent applied to tile drained fields at 1.1 inches showed no difference in runoff quality than the control fields, but application at three times the rate showed high levels of fecal coliform in the surface water. Fecal bacteria in runoff from land receiving fresh manure may often be a significant proportion of the fecal contamination measured in the surface waters. Vegetated filter strips are useful in removing pollutants from runoff on manured fields, particularly nutrients and sediment, but have not been identified as generally effective in reducing bacterial concentrations in the runoff. Surface applications of manure are more likely to result in fecal coliform transport when the soil is saturated, particularly in fine sandy loam soils.

EPA believes nutrient management practices and rates established in the PNP would limit the quantity of nutrients that may be applied to fields and will reduce the occurrence of manure application to saturated soils, or when a heavy storm event is predicted. Nutrient loss to surface water under these conditions would result in reduced crop yields and would be reflected in revisions made to the PNP in subsequent years translating to a lower manure application rate.

EPA has collected data on technologies useful in treating manure and wastes for pathogens. Anaerobic digesters and even simple manure storage for an extended period of time promote pathogen reductions through selective growth conditions and natural die-off over time. The addition of heat, such as is used in thermophilic digesters, further reduces pathogens. Proper composting processes also involve high temperatures—achieving temperatures approaching 140 degrees F in the pile. Heat treatment over several days is likely to kill protozoans such as Giardia and Cryptosporidium. The addition of lime to achieve high alkaline conditions, e.g., achieving a pH $\geq$ 12, also is effective at killing many pathogens by disrupting the cell membrane or disrupting virus viability.

EPA will continue to analyze the performance and applicability of treatments to reduce pathogens in CAFO waste, and will analyze the costs of these processes. The processes described above and others used to significantly reduce pathogens in biosolids or sewage sludge such as heat treatment, drying, thermophilic aerobic digestion, pasteurization, disinfection, and extended storage will be analyzed for their applicability to animal manures. EPA will give consideration to establishing the same performance standards as required for Class A sludge in Part 503. If supported by appropriate data, the final rule could establish these or other appropriate standards as performance standards that the wastes would be required to meet prior to land application. The CAFO would need to demonstrate achievement of these standards prior to land application because of the impracticability of measuring the pollutant loadings in any eventual runoff from the land application areas to the waters. EPA solicits comment on this possible approach and specifically requests data relating to pathogen treatment and reductions that are demonstrated to be effective on CAFO waste. EPA also solicits data on management practices that can be applied to the land application of manure, which may reduce pathogens in runoff.

10. Antibiotics

Related to concerns over pathogens in animal manures are concerns over antibiotics and other pharmaceuticals that may be present in the manure. As discussed in Section V, an estimated 60–80% of all livestock receive antibiotics. Some antibiotics are metabolized, and some are excreted with the manure. In cases where antimicrobials are administered to animals through the feed, spilt feed and wastelage may contribute to antibiotic content of the waste storage. The presence of antibiotics in manure and the environment has been shown to result in antibiotic resistant pathogens. EPA solicits comments on the direct effects of antibiotic residues and antimicrobial resistance, specifically on how manure management may contribute to the problem of antibiotics reaching the environment and contributing to pathogen resistance. EPA also solicits data and information on effective treatment or practices that may be implemented by CAFOs to reduce these releases.

IX. Implementation of Revised Regulations

A. How Do the Proposed Changes Affect State CAFO Programs?

EPA is proposing a number of changes to the effluent guidelines and the NPDES permit regulations for CAFOs in today's proposed rule. Under 40 CFR 123.25, authorized NPDES State programs must administer their permit programs in conformance with NPDES requirements, including the requirements that address concentrated animal feeding operations (§ 122.23) and the incorporation of technology-based effluent limitation guidelines and standards in permits (§ 122.44). Thus, today's proposed rule would require the 43 States [note that State is defined in § 122.2] with authorized NPDES permit programs for CAFOs to revise their programs as necessary to be consistent with the revised federal requirements. Current NPDES regulations note that authorized NPDES State permit programs are not required to be identical to the federal requirements; however, they must be at least as stringent as the federal program. States are not precluded from imposing requirements that are more stringent than those required under federal regulations.

Any State with an existing approved NPDES permitting program under section 402 must be revised to be consistent with changes to federal requirements within one year of the date of promulgation of final changes to the federal CAFO regulations [40 CFR 123.62(e)]. In cases where a State must amend or enact a statute to conform with the revised CAFO requirements, such revisions must take place within two years of final changes to the federal CAFO regulations. States that do not have an existing approved NPDES permitting program but who seek NPDES authorization after these CAFO regulatory provisions are promulgated must have authorities that meet or exceed the revised federal CAFO regulations at the time authorization is requested.

In States not authorized to administer the NPDES program, EPA will implement the revised requirements. Such States may still participate in water quality protection through participation in the CWA section 401 certification process (for any permits) as well as through other means (e.g., development of water quality standards, development of TMDLs, and coordination with EPA).

EPA is aware that the majority of States authorized to implement the NPDES program supplement the NPDES CAFO requirements with additional State requirements, and some States currently regulate or manage CAFOs predominantly under State non-NPDES programs. It has been suggested that EPA provide a mechanism through which State non-NPDES CAFO programs can be recognized alternatives that would be authorized under the CWA.

No permit issued by a non-NPDES program will satisfy the NPDES permit requirement. Facilities required to be covered by a NPDES permit must obtain a permit from an agency authorized to issue a NPDES permit. However, EPA believes that the current NPDES program provides a reasonable degree of flexibility consistent with CWA requirements, and that the proposed CAFO regulation provides opportunities to incorporate State programs in several ways.

It is possible for non-NPDES State programs that currently regulate AFOs to gain EPA's approval as NPDES-authorized programs. Such a change would require a formal modification of the State's approved NPDES program, and the State would have to demonstrate that its program meets all of the minimum criteria specified in 40 CFR Part 123, Subpart B for substantive and procedural regulations. Among other things, these criteria include the restriction that permit terms may not exceed 5 years, and include provisions on public participation in permit development and enforcement, and EPA enforcement authority.

In addition, today's proposal provides specific flexibility on particular issues. First, with regard to the off-site transfer of manure, EPA is requiring under one co-proposed option that the CAFO operator obtain a certification from recipients that, if they intend to land apply the manure, it will be done according to appropriate agricultural practices. EPA is proposing to waive this requirement in a State that is implementing an effective program for addressing excess manure generated by CAFOs. Second, EPA is proposing to require that processors be permitted, or co-permitted, along with their contract producers. EPA is requesting comment on an option that would waive this requirement in certain instances in States with effective programs for managing excess manure. EPA is also soliciting comment on one particular type of program, an Environmental Management System developed by the processor, as sufficient to waive co-permitting requirements. EPA is interested in comments on other specific requirements of today's proposal that might be satisfied in whole or in part by State program requirements. This could include ways to ensure that states with unique programs that meet or exceed the provisions of the revised regulations and the CWA requirements could utilize their own programs that include similar objectives such as enhanced water quality protection, public participation and accountability.

A third possible means of providing flexibility for States would be available if the three-tier regulatory structure is adopted in the final regulation. In the three-tier structure, all facilities over 1,000 AU would be considered CAFOs by definition, and those between 300 AU and 1,000 AU would be CAFOs only if they meet one of several conditions, described in detail in Section VII.B.3, or if designated by the permit authority as a significant contributor of pollution to waters of the U.S. Those with fewer that 300 AU would become CAFOs only if designated by the permit authority. A State with an effective non-NPDES program could succeed in helping many operations avoid permits by ensuring they do not meet any of the conditions that would define them as CAFOs.

EPA is also soliciting comment on whether or not to adopt both the two-tier and the three-tier structures, and to provide a mechanism to allow States to select which of the two alternative proposed structures to adopt in their State NPDES program. Under this option, a State could adopt the structure that best fits with the administrative structure of their program, and that best serves the character of the industries located in their State and the associated environmental problems. This option is viable only if the Agency is able to determine that the two structures provide substantially similar environmental benefits by regulating equivalent numbers of facilities and amounts of manure. Otherwise, States would be in a position to choose a less stringent regulation, contrary to the requirements of the Clean Water Act. A discussion of this option can be found in Section VII.B.4.

The requirements for State NPDES program authorization are specified under § 402(b) of the CWA and within the broad NPDES regulations (40 CFR Part 123). These provisions set out specific requirements for State authorization applicable to the entire NPDES program and the Agency does not believe that broad changes to these requirements are appropriate in this proposed rulemaking.

B. How Would EPA's Proposal to Designate CAFOs Affect NPDES Authorized States?

Today's proposal would provide explicit authority, even in States with approved NPDES programs, for the EPA Regional Administrator to designate an AFO as a CAFO if it meets the designation criteria in the regulations. EPA's authority to designate AFOs as CAFOs would be subject to the same criteria and limitations to which State designation authority is subject. However, EPA does not propose to assume authority or jurisdiction to issue permits to the CAFOs that the Agency designates in approved NPDES States. That authority would remain with the approved State. EPA requests comment on this prosed new designation authority.

C. How and When Will the Revised Regulations be Implemented?

EPA anticipates that this these proposed regulations will be promulgated as final regulations in December, 2002, and published in the **Federal Register** shortly thereafter (approximately January, 2003). As mentioned, authorized States programs will need up to two years after that date to revise their programs to reflect the new regulations. Following a State's revision of its program and approval of the revisions by EPA, we expect many States to want additional time to develop new or revised CAFO general permits. EPA believes it is reasonable to allow States one additional year to develop these new or revised general permits. To summarize, some States will need until approximately January 2006—i.e., three years after the final rule is published—before they can make CAFO general permits available that reflect the new regulations in the State.

At the same time, once these regulations are finalized, we estimate that there will be a large number of operations that will need to apply for a permit, described in Section VII.B.4. It is important to take into account that some States will not be making CAFO general permits available to these facilities until three years after the final rule. If EPA were to make the new Part 122 regulations effective shortly after we issue the final rule (January 2003), there would be large numbers of facilities that would be newly defined as CAFOs at that time. They would be required to apply for a permit right away, but States would not be able to issue general permits at that time or a large number of individual permits all at once. This would leave the facilities potentially in

the detrimental position of being unpermitted dischargers.

To avoid this situation, EPA proposes that the revisions to the CAFO definition in part 122 (including, for example, changes to the threshold number of animals to qualify as a CAFO and other changes such as the elimination of the 25-year, 24-hour storm exemption) would not take effect until three years after publication of the final rules. See proposed section 122.23(f). We expect, therefore, that these changes would not take effect until approximately January, 2006. Operations that are brought within the regulatory definition of a CAFO for the first time under these regulatory revisions would not be defined as CAFOs under final and effective regulations until that date.

EPA also considered an alternate approach in which the effective date for the part 122 revisions would be different in each State, depending on when the State actually adopted and got approval for the changes and issued general permits. An advantage of this approach would be that the new regulations would potentially be effective at an earlier date, i.e., before January 2006, in some States. EPA is not proposing this approach, however. We decided that it would be preferable to provide one uniform effective date for these particular revisions, which would provide necessary clarity and consistency to the national NPDES program for CAFOs. EPA does seek comment, however, on which approach would be preferable to adopt in the final regulations. States, however, are free to implement more stringent requirements, and may choose to implement the revised CAFO definition at an earlier date.

It should be noted that EPA is proposing this delayed effective date only for the proposed regulatory changes that affect which operations would be defined as CAFOs. There is no need to delay the effective date of any of the other revisions EPA is proposing to the CAFO regulations at 40 CFR part 122, such as those that specify land application requirements and other requirements. These other revisions to the part 122 regulations would become effective 60 days after publication of the final regulations (January 2003). For any operation that is a CAFO according to the current definition and that is being permitted after that date, or having its permit renewed, the permit would be developed under these new part 122 provisions.

EPA is proposing that the revised effluent guidelines, once promulgated as final regulations, would be effective 60 days after promulgation. The 1989 statutory deadline for meeting BAT has long passed, and we do not believe there is any reason why permit writers could not begin incorporating the revised effluent guidelines into permits beginning 60 days after promulgation.

If a CAFO submits a timely application for a permit renewal, but has not received a decision on that application prior to the expiration date of the original permit, then the original permit would be administratively ''continued'' until there is a decision from the permit authority on the new application (in EPA-administered States and States with comparable administrative procedure laws). If that continuance lasts beyond the date that is the effective date of the revised NPDES regulations and effluent guidelines, then the CAFO's new permit would reflect both sets of new regulations.

EPA also proposes to adopt specific timing requirements in the permit with respect to the CAFO's development of PNPs. As described in Section VIII, EPA proposes to establish BAT as encompassing the following timing requirements: (1) for all new permittees and for applicants who hold existing individual permits, compliance with the PNP would be an immediate requirement of the permit. Therefore, the draft PNP must be submitted to the permit authority along with the permit application or NOI; the final PNP must be adopted by the permittee within 90 days of being permitted; (2) for applicants who are authorized under an existing general permit, the permittee must develop a Permit Nutrient Plan within 90 days of submittal of the NOI; and (3) the PNP for all CAFOs would need to include milestones for implementation. This time is necessary because, while operators can begin preparing necessary data, it would be difficult to develop a PNP before the permit authority issues a final permit that specifies the terms and conditions of the permit. (Operators of existing CAFOs with individual NPDES permits, who must submit their draft PNP with the permit application, are expected to reapply for coverage under the revised regulation early enough to provide time to develop its PNP without causing a lapse in coverage.) For facilities that have been designated as CAFOs, the permit writer will develop the implementation schedule in order to provide reasonable time to prepare the PNP.

Prior to the effective date of the revised regulations, State and EPA permit authorities will be issuing permits to facilities that currently meet the definition of a CAFO under the existing regulations or that have been designated as CAFOs. Consistent with the AFO Strategy, discussed in section III.B., during 2000 to 2005 States with authorized NPDES programs are to focus on issuing permits to the largest CAFOs, those with 1,000 AU or greater. In States where EPA is the permit authority, EPA will issue permits to operations defined as CAFOs that are over 300 AU. The permits are valid for a maximum of five years, at which time these facilities would obtain new permits under the revised regulation.

One of the significant changes to the NPDES and ELG regulation for CAFOs will be the requirement to develop and implement Permit Nutrient Plans that are developed, or reviewed and approved, by certified planners. Concern has been raised about the availability of the necessary expertise to develop and certify the plans. EPA believes that there will be sufficient lead time before this regulation is implemented to expect the market to have developed the CNMP and PNP planning expertise and infrastructure because, during this period, CNMPs will be developed under both the USDA voluntary program and EPA's Round I permitting.

For facilities subject to the requirements of the revised regulation, EPA anticipates that during the period between the time this regulation is promulgated and the time it is effective, operators will be able to anticipate the status of their facilities, and therefore can begin gathering data that will be needed for the Permit Nutrient Plan and other requirements, such as soil type, manure sampling, cropping information, and other data needed to calculate the allowable manure application rate. (Note: States are supposed to have adopted their NRCS 590 standard by May 2001.)

EPA also proposes that CAFOs that are new sources may not receive permit coverage until the PNP is developed. In this case, a complete application must include the PNP. The owner or operator of a new facility is expected to design and construct the new facility in a manner that anticipates the ELG and NPDES requirements for manure management, rather than incurring the costs of retrofitting an already constructed facility.

EPA recognizes that some practices such as liners and groundwater wells for beef and dairy operations may take time to implement. The PNP will include a schedule for implementing the provisions of the PNP, including milestones with dates.

Facilities Constructed After the Proposed Regulation is Published. EPA is soliciting comment on whether the revised regulations should apply 60 days after publication of the final rule to facilities that commence operation after that date, even if they would not be defined as a CAFO under the existing rules. Although EPA is proposing to delay for three years the effective date of the proposed regulations for existing facilities that are not currently defined as CAFOs, it is considering whether to require all facilities defined as CAFOs under the final rule that commence operation after the final rule is published to obtain an NPDES permit and comply with the other requirements of the final rule. For example, a dry poultry operation or an animal feeding operation of 501 cattle that is constructed during the three year period after publication of the final rule might be required to comply immediately with the revised regulations rather than remaining outside the scope of the NPDES program until three years after publication of the final rule.

Requiring newly constructed facilities to obtain permits does not pose the same problem as requiring all existing AFOs which are not defined as CAFOs under the current rule to obtain permits immediately after promulgation of the final rule. Once a new definition of a CAFO becomes effective, a large number of existing facilities would need a permit on the same date. EPA expects that most existing facilities will seek coverage under a general permit. However, EPA and authorized States will need some time after the final rule is promulgated to develop those general permits. An existing facility would face the dilemma of either ceasing operations or discharging without a permit if it was required to obtain a permit but none was available. By contrast, new facilities would commence operation over a period of time and present less of a burden on permit authorities. If a general permit was not available, issuing individual permits to the smaller number of newly constructed facilities would present less of a burden. If all else fails, a newly constructed facility could not commence operation until it had a permit. This approach would be consistent with EPA's general approach for regulation of new sources and new dischargers, who are required to obtain an NPDES permit (and comply with any applicable NSPS) prior to commencing operation. See 40 CFR 122.29, 124.60(a). Finally, unlike an existing facility, a newly constructed facility is in a better position to plan its facility to comply with the revised regulations.

If EPA did not delay the effective date for facilities that are constructed after the final rule is published, the rule would address additional sources sooner. On the other hand it would further complicate the regulatory structure because it would temporarily create another category of facilities. EPA solicits comments on whether all provisions of the rule should be effective 60 days after the final rule is published for facilities that are constructed after that date.

D. How Many CAFOs are Likely to be Permitted in Each State and EPA Region?

Tables 9–1 and 9–2 delineate the number of facilities, in each State and EPA Region, that are expected to be affected by either of today's proposed two-tier and three-tier structures, respectively. In both proposed structures, all CAFOs with more than 1,000 AU would be required to apply for a NPDES permit. The differences lie primarily in how the middle-sized operations are affected.

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Table 9-1. Projected Estimated Number of Potential CAFOs Potentially Regulated Under the Three-Tier Structure by Region, State and Size

EPA Region	State	<300 AU		300-1,000 AU		>1,000 AU		Total	
			Regional Subtotal		Regional Subtotal		Regional Subtotal		Regional Subtotal
Region 1	Connecticut	0		39		9		48	
	Maine	0		60		8		68	
	Massachusetts	0		41		7		48	
	New Hampshire	0		29		4		33	
	Rhode Island	0		5		0		5	
	Vermont	0		129		15		144	
			0		**303**		**43**		**346**
Region 2	New Jersey	0		27		6		33	
	New York	0		514		79		593	
			0		**542**		**85**		**627**
Region 3	Delaware	0		332		97		429	
	Maryland	0		437		137		573	
	Pennsylvania	0		628		321		949	
	Virginia	0		551		216		767	
	West Virginia	0		135		75		210	
			0		**2,084**		**845**		**2,929**
Region 4	Alabama	0		1,224		557		1,782	
	Florida	0		247		169		416	
	Georgia	0		1,360		834		2,193	
	Kentucky	0		233		179		412	
	Mississippi	0		766		433		1,199	
	N. Carolina	0		1,454		1,218		2,672	
	S. Carolina	0		306		201		508	
	Tennessee	0		265		114		378	
			0		**5,854**		**3,706**		**9,560**
Region 5	Illinois	1		461		377		839	
	Indiana	1		455		328		784	
	Michigan	1		345		144		490	
	Minnesota	2		785		496		1,283	
	Ohio	0		369		217		586	
	Wisconsin	3		574		141		718	
			8		**2,988**		**1,704**		**4,700**

EPA Region	State	<300 AU		300-1,000 AU		>1,000 AU		Total	
			Regional Subtotal		Regional Subtotal		Regional Subtotal		Regional Subtotal
Region 6	**Arkansas**	0		1,418		580		1,999	
	Louisiana	0		211		86		297	
	New Mexico	0		30		112		141	
	Oklahoma	0		289		175		464	
	Texas	0		841		675		1,516	
			0		**2,789**		**1,629**		**4,418**
Region 7	**Iowa**	2		1,440		1,318		2,760	
	Kansas	0		188		277		465	
	Missouri	0		449		321		770	
	Nebraska	0		442		641		1,083	
			2		**2,519**		**2,557**		**5,078**
Region 8	**Colorado**	0		121		210		331	
	Montana	0		32		55		87	
	North Dakota	0		35		28		63	
	South Dakota	0		181		177		358	
	Utah	0		123		53		176	
	Wyoming	0		18		24		42	
			0		**509**		**548**		**1,057**
Region 9	**Arizona**	0		30		83		113	
	California	0		956		1,031		1,988	
	Hawaii	0		16		16		33	
	Nevada	0		15		20		35	
			0		**1,017**		**1,151**		**2,168**
Region10	**Alaska**	0		3		1		4	
	Idaho	0		176		151		328	
	Oregon	0		156		72		228	
	Washington	0		320		168		488	
			0		**655**		**392**		**1,047**
Total Potential Permittees		**10**		**19,260**		**12,660**		**31,930**	

Note: An additional 7,000 facilities in the 300 AU to 1,000 AU size category would potentially be subject to the rule, but are projected to file a certification indicating that they do not need to apply for a permit.

Table 9-2. Projected Estimated Number of Potential CAFOs Potentially Regulated Under the Two-Tier Structure by Region, State and Size

EPA Region	State	<500 AU		500-1,000 AU		>1,000 AU		Grand Total	
			Regional Subtotal		Regional Subtotal		Regional Subtotal		Regional Subtotal
Region 1	**Connecticut**	1		22		9		32	
	Maine	1		30		8		39	
	Massachusetts	1		21		7		29	
	New Hampshire	1		15		4		20	
	Rhode Island	0		2		0		3	
	Vermont	3		64		15		82	
			7		**153**		**43**		**204**
Region 2	**New Jersey**	1		15		6		22	
	New York	21		259		79		359	
			22		**274**		**85**		**380**
Region 3	**Delaware**	3		169		97		268	
	Maryland	5		229		137		371	
	Pennsylvania	15		380		320		715	
	Virginia	10		325		216		552	
	West Virginia	1		94		75		170	
			34		**1,197**		**846**		**2,076**
Region 4	**Alabama**	1		719		557		1,278	
	Florida	1		178		170		349	
	Georgia	5		936		833		1,774	
	Kentucky	7		165		179		351	
	Mississippi	1		488		433		922	
	N. Carolina	0		911		1,221		2,133	
	S. Carolina	1		231		202		434	
	Tennessee	0		148		114		261	
			16		**3,776**		**3,710**		**7,502**
Region 5	**Illinois**	14		420		377		811	

EPA Region	State	<500 AU		500-1,000 AU		>1,000 AU		Grand Total	
			Regional Subtotal		Regional Subtotal		Regional Subtotal		Regional Subtotal
	Indiana	6		396		328		730	
	Michigan	9		222		144		375	
	Minnesota	30		621		496		1,147	
	Ohio	3		269		217		489	
	Wisconsin	25		309		141		475	
			87		**2,237**		**1,703**		**4,027**
Region 6	Arkansas	1		777		579		1,357	
	Louisiana	0		120		86		206	
	New Mexico	0		26		112		138	
	Oklahoma	0		165		175		340	
	Texas	0		532		676		1,208	
			1		**1,620**		**1,628**		**3,249**
Region 7	Iowa	58		1,374		1,318		2,750	
	Kansas	5		182		277		464	
	Missouri	9		323		321		652	
	Nebraska	11		437		640		1,087	
			83		**2,315**		**2,556**		**4,953**
Region 8	Colorado	0		81		210		291	
	Montana	0		25		55		80	
	North Dakota	0		27		28		54	
	South Dakota	0		149		177		326	
	Utah	0		65		53		118	
	Wyoming	0		9		24		33	
			0		**355**		**548**		**902**
Region 9	Arizona	0		23		83		106	
	California	0		545		1,029		1,574	
	Hawaii	0		10		16		26	
	Nevada	0		8		21		29	
			0		**586**		**1,149**		**1,735**
Region10	Alaska	0		2		1		3	
	Idaho	0		97		151		248	
	Oregon	0		82		72		153	
	Washington	0		167		169		336	
			0		**348**		**393**		**741**
Total Potential Permittees		**250**	**250**	**12,860**	**12,860**	**12,660**	**12,660**	**25,770**	**25,770**

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As described in today's preamble, the three-tier structure would affect more facilities because all AFOs with 300 AU or more would be required to do something. However, not all would be required to apply for a permit, and, depending on the vigor with which States and AFOs seek to avoid the conditions defining these facilities as CAFOs, the actual number of permittees could be smaller. EPA projects that a minimum of 4,000 middle-sized facilities and a maximum of 19,000 would apply for a permit under the three-tier structure. By contrast, the proposed two-tier structure would require all 13,000 facilities between 500 AU and 1,000 AU to apply for a permit.

Further, the number of small facilities likely to be designated differs between the two proposed structures. Under the three-tier structure, EPA expects very few AFOs to be designated, potentially 10 per year nationally. Under the two-tier structure, however, this number is likely to rise to 50 per year, given that AFOs from 300 AU to 499 AU have the potential to generate significant quantities of manure that, if not properly managed, may lead the facility to be a significant contributor of pollution to the waters.

E. Funding Issues

While most CAFO owners and operators are interested in taking appropriate measures to protect and preserve the environment, there are legitimate concerns over the costs of doing so. While EPA's cost analysis indicates that this rule is affordable, some businesses in some locales may experience economic stress. (See Section X). Further, concern has been expressed as to whether facilities below 1,000 AU that become CAFOs due to the changes in this proposed rulemaking may potentially cause operations to lose cost-share money available under EPA's Section 319 Nonpoint Source Program and USDA's Environmental Quality Incentive Program (EQIP). Once a facility is considered a point source under NPDES, the operation is not eligible for cost sharing under the Section 319 nonpoint source program. However, the USDA EQIP program is in fact available to most facilities, and being a permitted CAFO is not a reason for exclusion from the EQIP program. EQIP funds may not be used to pay for construction of storage facilities at operations with greater than 1,000 USDA animal units; however, EQIP is available to these facilities for technical assistance and financial assistance for other practices. One USDA animal unit equals 1,000 pounds of live weight of any given livestock species or any combination of livestock species. (The approximate number of animal equivalents would be: 1,000 head of beef; 741 dairy cows; 5,000 swine, 250,000 layers; and 500,000 broilers).

To this end, EPA anticipates that State and Federal Agencies will facilitate compliance with this rule by providing technical assistance and funding for smaller CAFOs, as available.

F. What Provisions are Made for Upset and Bypass?

A recurring issue of concern has been whether industry guidelines should include provisions authorizing noncompliance with effluent limitations during periods of ''upsets'' or ''bypasses''. An upset, sometimes called an ''excursion,'' is an unintentional noncompliance occurring for reasons beyond the reasonable control of the permittee. It has been argued that an upset provision is necessary in EPA's effluent limitations because such upsets will inevitably occur even in properly operated control equipment. Because technology based limitations require only what the technology can achieve, it is claimed that liability for such situations is improper. When confronted with this issue, courts have disagreed on whether an explicit upset exemption is necessary, or whether upset incidents may be handled through EPA's exercise of enforcement discretion. Compare *Marathon Oil Co.* v. *EPA,* 564 F.2d 1253 (9th Cir.1977), with *Weyerhaeuser* v. *Costle,* 594 F.2d 1223 (8th Cir. 1979). See also *Sierra Club* v. *Union Oil Co.,* 813 F.2d 1480 (9th Cir. 1987), *American Petroleum Institute* v. *EPA,* 540 F.2d 1023 (10th Cir. 1976), *CPC International, Inc.* v. *Train,* 540 F.2d 1320 (8th Cir. 1976), and *FMC Corp.* v. *Train,* 539 F.2d 973 (4th Cir. 1976).

A bypass, on the other hand, is an act of intentional noncompliance during which waste treatment facilities are circumvented because of an emergency situation. EPA has in the past included bypass provisions in NPDES permits. EPA has determined that both upset and bypass provisions should be included in NPDES permits and has promulgated permit regulations that include upset and bypass permit provisions. See 40 CFR 122.41. The upset provision establishes an upset as an affirmative defense to prosecution for violation of, among other requirements, technology-based effluent limitations. The bypass provision authorizes bypassing to prevent loss of life, personal injury, or severe property damage. Consequently, although permittees in the offshore oil and gas industry will be entitled to upset and bypass provisions in NPDES permits, this regulation does not address these issues.

G. How Would an Applicant Apply for Variances and Modifications to Today's Proposed Regulation?

Once this regulation is in effect, the effluent limitations must be applied in all NPDES permits thereafter issued to discharges covered under this effluent limitations guideline subcategory. The CWA, however, provides certain variances from BAT and BCT limitations. Under 301(l), the only variance available for discharges from the production area is an FDF variance under 301(m). For the land application area, 301(g) variances don't apply because EPA is not setting BAT effluent limitations for the five pollutants to which that provision applies. 301(c) and FDF variances are available for effluent limitations covering the land application area.

The Fundamentally Different Factors (FDF) variance considers those facility specific factors which a permittee may consider to be uniquely different from those considered in the formulation of an effluent guideline as to make the limitations inapplicable. *An FDF variance must be based only on information submitted to EPA during the rulemaking establishing the effluent limitations from which the variance is being requested, or on information the applicant did not have a reasonable opportunity to submit during the rulemaking process for these effluent limitations guidelines.* If fundamentally different factors are determined, by the permitting authority (or EPA), to exist, the alternative effluent limitations for the petitioner must be no less stringent than those justified by the fundamental difference from those facilities considered in the formulation of the specific effluent limitations guideline of concern. The alternative effluent limitation, if deemed appropriate, must not result in non-water quality environmental impacts significantly greater than those accepted by EPA in the promulgation of the effluent limitations guideline. FDF variance requests with all supporting information and data must be received by the permitting authority within 180 days of publication of the final effluent limitations guideline (Publication date here). The specific regulations covering the requirements for and the administration of FDF variances are found at 40 CFR 122.21(m)(1), and 40 CFR part 125, subpart D.

X. What Are the Costs and Economic Impacts of the Proposed Revisions?

A. Introduction and Overview

This section presents EPA's estimates of the costs and economic impacts that would occur as a result of today's proposed regulations. Costs and economic impacts are evaluated for each commodity sector, including the beef, veal, heifer, dairy, swine, broiler, turkey and egg laying sectors. A description of each of the ELG technology options and the NPDES scenarios considered by EPA, and the rationale for selecting the proposed BAT Option and NPDES Scenario, are provided in Sections VII and VIII of this document. Detailed information on estimated compliance costs are provided in the Development Document for the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations (referred to as the ''Development Document''). EPA's detailed economic assessment can be found in Economic Analysis of the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations (referred to as ''Economic Analysis''). EPA also prepared the Environmental and Economic Benefit Analysis of the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations (''Benefits Analysis'') in support of today's proposal. These documents are available at EPA's website at *http://www.epa.gov/owm/afo.htm.*

This section presents EPA's estimate of the total annual incremental costs and the economic impacts that would be incurred by the livestock and poultry industry as a result of today's proposed rule. This section also discusses EPA's estimated effects to small entities and presents the results of EPA's cost-effectiveness and cost-benefit analysis. All costs presented in this document are reported in 1999 pre-tax dollars (unless otherwise indicated).

B. Data Collection Activities

1. Sources of Data To Estimate Compliance Costs

As part of the expedited approach to this rulemaking, EPA has chosen not to conduct an industry-wide survey of all CAFOs using a Clean Water Act Section 308 questionnaire. Rather, EPA is relying on existing data sources and expertise provided by the U.S. Department of Agriculture (USDA), industry, State agriculture extension agencies, and several land grant universities. More detailed information on the data used for this analysis can be found in the Development Document and also the Economic Analysis.

EPA collected and evaluated data from a variety of sources. These sources include information compiled through EPA site visits to over 100 animal confinement operations and information from industry trade associations, government agencies, and other published literature. EPA also received information from environmental groups such as the Natural Resources Defense Council and the Clean Water Network. The Agency contacted university experts, state cooperatives and extension services, and state and EPA regional representatives to identify facilities for site visits. EPA also attended USDA-sponsored farm tours and site visits arranged by other groups, as well as industry, academic, and government conferences.

EPA obtained data and information from several agencies in USDA, including the National Agricultural Statistics Service (NASS), Natural Resources Conservation Service (NRCS), the Animal and Plant Health Inspection Service (APHIS), and the Economic Research Service (ERS). The collected data include statistical survey information and published reports.

EPA gathered information from a wide range of published NASS reports, including annual data summaries for each commodity group. USDA's NASS is responsible for objectively providing important, usable, and accurate statistical information and data support services on the structure and activities of agricultural production in the United States. Each year NASS conducts surveys and prepares reports covering virtually every facet of U.S. agricultural production. The primary sources of data are animal production facilities in the United States. NASS collects voluntary information using mail surveys, telephone and in-person interviews, and field observations. NASS is also responsible for conducting a Census of Agriculture.

EPA's main source of primary USDA data containing farm level descriptive information is USDA's Census of Agriculture (Census). USDA's Census is a complete accounting of United States agricultural production and is the only source of uniform, comprehensive agricultural data for every county in the nation. The Census is conducted every 5 years by NASS. The Census includes all farm operations from which $1,000 or more of agricultural products are produced and sold. The most recent Census reflects calendar year 1997 conditions. This database is maintained by USDA. Data used for this analysis were compiled with the assistance of staff at USDA's NASS. (USDA periodically publishes aggregated data from these databases and also compiles customized analyses of the data to members of the public and other government agencies. In providing such analyses, USDA maintains a sufficient level of aggregation to ensure the confidentiality of any individual operation's activities or holdings.)

USDA's NRCS publishes the Agricultural Waste Management Field Handbook, which is an agricultural engineering guidance manual that explains general waste management principles and provides detailed design information for particular waste management systems. USDA's Handbook reports specific design information on a variety of farm production and waste management practices at different types of feedlots. The Handbook also reports runoff calculations under normal and peak precipitation as well as information on manure and bedding characteristics. EPA used this information to develop its cost and environmental analyses. NRCS personnel also contributed technical expertise in the development of EPA's estimates of compliance costs and environmental assessment framework by providing EPA with estimates of manure generation in excess of expected crop uptake. This information is provided in the record that supports this rulemaking.

NRCS also compiled and performed analyses on Census data that EPA used for its analyses. These data identify the number of feedlots, their geographical distributions, and the amount of cropland available to land apply animal manure generated from their confined feeding operations (based on nitrogen and phosphorus availability relative to crop need).

EPA gathered information from several reports on the livestock and poultry industries from the National Animal Health Monitoring System (NAHMS). USDA's APHIS provides leadership in ensuring the health and care of animals and plants, improving agricultural productivity and competitiveness, and contributing to the national economy and public health. One of its main responsibilities is to enhance the care of animals. In 1983, APHIS initiated the NAHMS as an information-gathering program to collect, analyze, and disseminate data on animal health, management, and productivity. NAHMS conducts national studies to gather data and generate

descriptive statistics and information from data collected by other industry sources.

USDA's ERS provides economic analyses on efficiency, efficacy, and equity issues related to agriculture, food, the environment, and rural development to improve public and private decision-making. EPA's analysis of economic impacts at a model CAFO references a wide range of published ERS reports and available farm level statistical models. ERS also maintains farm level profiles of cost and returns compiled from NASS financial data.

Databases and reports containing the information and data used by EPA in support of this proposed rule are available in the rulemaking record.

2. Sources of Data To Estimate Economic Impacts

To estimate economic impacts, EPA used farm level data from USDA, industry, and land grant universities. The major source of primary USDA data on farm financial conditions is from the Agricultural Resources Management Study (ARMS). ARMS is USDA's primary vehicle for data collection on a broad range of issues about agricultural production practices and costs. These data provide a national perspective on the annual changes in the financial conditions of production agriculture.

USDA's ARMS data provide aggregate farm financial data, which EPA used for its cost impact analysis. The ARMS data provide complete income statement and balance sheet information for U.S. farms in each of the major commodity sectors, including those affected by the proposed regulations. The ARMS financial data span all types of farming operations within each sector, including full-time and part-time producers, independent owner operations and contract grower operations, and confinement and non-confinement production facilities.

ERS provided aggregated data for select representative farms through special tabulations of the ARMS data that differentiate the financial conditions among operations by commodity sector, facility size (based on number of animals on-site) and by major producing region for each sector. The 1997 ARMS data also provide corresponding farm level summary information that matches the reported average financial data to both the total number of farms and the total number of animals for each aggregated data category. As with the Census data, ERS aggregated the data provided to EPA to preserve both the statistical representativeness and confidentiality of the ARMS survey data. ARMS data used for this analysis are presented in the Economic Analysis and are available in the rulemaking record.

EPA obtained additional market data on the U.S. livestock and poultry industries as a whole from a wide variety of USDA publications and special reports. These include: Financial Performance of U.S. Commercial Farms, 1991–1994; USDA Baseline Projections 2000, Food Consumption, Prices and Expenditures, 1970–1997; Agricultural Prices Annual Summary; annual NASS statistical bulletins for these sectors; and data and information reported in Agricultural Outlook and ERS's Livestock, Dairy, and Poultry Situation and Outlook reports. Other source material is from ERS's cost of production series reports for some sectors and trade reports compiled by USDA's Foreign Agricultural Service (FAS). Information on the food processing segments of these industries is from the U.S. Department of Commerce's Census of Manufacturers data series. Industry information is also from USDA's Grain Inspection Packers and Stockyards Administration (GIPSA).

Industry and the associated trade groups also provided information for EPA's cost and market analyses. In particular, the National Cattlemen's Beef Association (NCBA) conducted a survey of its membership to obtain financial statistics specific to cattle feeding operations. EPA used these and other data to evaluate how well the ARMS data for beef operations represent conditions at cattle feedyards. EPA also obtained industry data from the National Milk Producers Federation (NMPF) and the National Pork Producers Council (NPPC).

EPA also used published research by various land grant universities and their affiliated research organizations, as well as information provided by environmental groups.

Databases and reports containing the information and data provided to and used by EPA in support of this proposed rule are available in the rulemaking record.

C. Method for Estimating Compliance Costs

1.Baseline Compliance

For the purpose of this analysis, EPA assumes that all CAFOs that would be subject to the proposed regulations are currently in compliance with the existing regulatory program (including the NPDES regulations and the effluent limitations guidelines and standards for feedlots) and existing state laws and regulations. As a practical matter, EPA recognizes that this is not true, since only 2,500 operations out of an estimated 12,700 CAFOs with more than 1,000 AU have actually obtained coverage under an NPDES permit and the remainder may in fact experience additional costs to comply with the existing requirements. EPA has not estimated these additional costs in the analysis that is presented in today's preamble because the Agency did not consider these costs part of the incremental costs of complying with today's proposed rule.

To assess the incremental costs attributable to the proposed rules, EPA evaluated current federal and state requirements for animal feeding operations and calculated compliance costs of the proposed requirements that exceed the current requirements. Operations located in states that currently have requirements that meet or exceed the proposed regulatory changes would already be in compliance with the proposed regulations and would not incur any additional cost. These operations are not included as part of the cost analysis. A review of current state waste management requirements for determining baseline conditions is included in the Development Document and also in other sections of the record (See State Compendium: Programs and Regulatory Activities Related to Animal Feeding Operations compiled by EPA and available at http://www.epa.gov/owm/afo.htm#Compendium).

EPA also accounted for current structures and practices that are assumed to be already in place at operations that may contribute to compliance with the proposed regulations. Additional information is also provided in the following section (X.C.2(a)). This information is also provided in the Development Document.

2. Method for Estimating Incremental CAFO Compliance Costs

a. *Compliance Costs to CAFO Operators.* For the purpose of estimating total costs and economic impacts, EPA calculated the costs of compliance for CAFOs to implement each of the regulatory options being considered (described in Section VIII of this preamble). EPA estimated costs associated with four broad cost components: nutrient management planning, facility upgrades, land application, and technologies for balancing on-farm nutrients. Nutrient management planning costs include manure and soil testing, record keeping, monitoring of surface water and groundwater, and plan development. Facility upgrades reflect costs for

manure storage, mortality handling, storm water and field runoff controls, reduction of fresh water use, and additional farm management practices. Land application costs address agricultural application of nutrients and reflect differences among operations based on cropland availability for manure application. Specific information on the capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA to estimate costs and impacts of the proposed regulations is provided in the Development Document.

EPA evaluated compliance costs using a representative facility approach based on more than 170 farm level models that were developed to depict conditions and to evaluate compliance costs for select representative CAFOs. The major factors used to differentiate individual model CAFOs include the commodity sector, the farm production region, and the facility size (based on herd or flock size or the number of animals on-site). EPA's model CAFOs primarily reflect the major animal sector groups, including beef cattle, dairy, hog, broiler, turkey, and egg laying operations. Practices at other subsector operations are also reflected in the cost models, such as replacement heifer operations, veal operations, flushed caged layers, and hog grow- and farrow-finish facilities. EPA used model facilities with similar waste management and production practices to depict operations in regions that were not separately modeled.

Another key distinguishing factor incorporated into EPA's model CAFOs includes information on the availability of crop and pasture land for land application of manure nutrients. For this analysis, nitrogen and phosphorus rates of land application are evaluated for three categories of cropland availability: Category 1 CAFOs are assumed to have sufficient cropland for all on-farm nutrients generated, Category 2 CAFOs are assumed to have insufficient cropland, and Category 3 CAFOs are assumed to have no cropland. EPA used 1997 information from USDA to determine the number of CAFOs within each category. This information takes into account which nutrient (nitrogen or phosphorus) is used as the basis to assess land application and nutrient management costs.

For Category 2 and Category 3 CAFOs, EPA evaluated additional technologies that may be necessary to balance nutrients. EPA evaluated additional technologies that reduce off-site hauling costs associated with excess on-farm nutrients, as well as to address ammonia volatization, pathogens, trace metals, and antibiotic residuals. These technologies may include Best Management Practices (BMPs) and various farm production technologies, such as feed management strategies, solid-liquid separation, composting, anaerobic digestion, and other retrofits to existing technologies. EPA considered all these technologies for identification of ''best available technologies'' under the various options for BAT described in Section VIII.

EPA used soil sample information compiled by researchers at various land grant universities to determine areas of phosphorus and nitrogen saturation, as described in the Development Document. This information provides the basis for EPA's assumptions of which facilities would need to apply manure nutrients on a phosphorus- or nitrogen-based standard.

EPA's cost models also take into account other production factors, including climate and farmland geography, land application and waste management practices and other major production practices typically found in the key producing regions of the country. Model facilities reflect major production practices used by larger confined animal farms, generally those with more than 300 AU. Therefore, the models do not reflect pasture and grazing type farms, nor do they reflect typical costs to small farms. EPA's cost models also take into account practices required under existing state regulations and reflect cost differences within sectors depending on manure composition, bedding use, and process water volumes. More information on the development of EPA's cost models is provided in the Development Document.

To estimate aggregate incremental costs to the CAFO industry from implementing a particular technology option, EPA first estimated the total cost to a model facility to employ a given technology, including the full range of necessary capital, annual, start-up, and recurring costs. Additional detailed information on the baseline and compliance costs attributed to model CAFOs across all sectors and across all the technology options considered by EPA is provided in the Development Document.

After estimating the total cost to an individual facility to employ a given technology, EPA then weighted the average facility level cost to account for current use of the technology or management practice nationwide. This is done by multiplying the total cost of a particular technology or practice by the percent of operations that are believed to use this particular technology or practice in order to derive the average expected cost that could be incurred by a model CAFO. EPA refers to this adjustment factor as the ''frequency factor'' and has developed such a factor for each individual cost (i.e. each technology) and cost component (i.e. capital and annual costs) in each of its CAFO models. The frequency factor reflects the percentage of facilities that are, technically, already in compliance with a given regulatory option since they already employ technologies or practices that are protective of the environment. The frequency factor also accounts for compliance with existing federal and state regulatory requirements as well as the extent to which an animal sector has already adopted or established management practices to control discharges.

EPA developed its frequency factors based on data and information from USDA's NRCS and NAHMS, state agricultural extension agencies, industry trade groups and industry-sponsored surveys, academic literature, and EPA's farm site visits. More detailed information on how EPA developed and applied these weighting factors is provided in the Development Document. To identify where farm level costs may be masked by this weighting approach, EPA evaluated costs with and without frequency factors. The results of this sensitivity analysis indicate that the model CAFO costs used to estimate aggregate costs and impacts, as presented in this preamble, are stable across a range of possible frequency factor assumptions.

The data and information used to develop EPA's model CAFOs were compiled with the assistance of USDA, in combination with other information collected by EPA from extensive literature searches, more than 100 farm site visits, and numerous consultations with industry, universities, and agricultural extension agencies. Additional detailed information on the data and assumptions used to develop EPA's model CAFOs that were used to estimate aggregate incremental costs to the CAFO industry is provided in the Development Document.

b. *Compliance Costs to Recipients of CAFO Manure.* To calculate the cost to offsite recipients of CAFO manure under the proposed regulations, EPA builds upon the cropland availability information in the CAFO models, focusing on the two categories of farms that have excess manure nutrients and that need to haul manure offsite for alternative use or to be spread as

fertilizer (i.e., Category 2 and Category 3 CAFOs, where facilities are assumed to have insufficient or no available cropland to land apply nutrients, respectively). EPA also uses this information to determine the number of offsite recipients affected under select regulatory alternatives, shown in Tables 10–3 and 10–4.

USDA defines farm level ''excess'' of manure nutrients on a confined livestock farm as manure nutrient production less crop assimilative capacity. USDA has estimated manure nutrient production using the number of animals by species, standard manure production per animal unit, and nutrient composition of each type of manure. Recoverable manure is the amount that can be collected and disposed by spreading on fields or transporting off the producing farm.

Depending on the nutrient used to determine the rate of manure application (nitrogen or phosphorus), EPA estimates that approximately 7,500 to 10,000 CAFOs with more than 300 AU are expected to generate excess manure. This includes about 2,600 animal feeding operations that have no major crop or pasture land. These estimates were derived from a USDA analysis of manure nutrients relative to the capacity of cropland and pastureland to assimilate nutrients. EPA's estimate does not account for excess manure that is already disposed of via alternative uses such as pelletizing or incineration.

For the purpose of this analysis, EPA assumes that affected offsite facilities are field crop producers who use CAFO manure as a fertilizer substitute. Information on crop producers that currently receive animal manure for use as a fertilizer substitute is not available. Instead, EPA approximates the number of operations that receive CAFO manure and may be subject to the proposed regulations based on the number of acres that would be required to land apply manure nutrients generated by Category 2 and Category 3 CAFOs. EPA assumes that offsite recipients will only accept manure when soil conditions allow for application on a nitrogen basis. Therefore, the manure application rate at offsite acres in a given region is the nitrogen-based application rate for the typical crop rotation and yields obtained in that region. EPA then estimates the number of farms that receive CAFO manure by dividing the acres needed to assimilate excess manure nitrogen by the national average farm size of 487 acres, based on USDA data. The results of this analysis indicate that 18,000 to 21,000 offsite recipients would receive excess CAFO manure.

The costs assessed to manure recipients include the costs of soil testing and incremental recordkeeping. EPA evaluated these costs using the approach described in Section X.C.2(a). Excess manure hauling costs are already included in costs assessed to CAFOs with excess manure. For the purpose of this analysis, EPA has assumed that crop farmers already maintain records documenting crop yields, crop rotations, and fertilizer application, and that crop farmers already have some form of nutrient management plan for determining crop nutrient requirements. EPA estimates, on average, per-farm incremental costs of approximately $540 to non-CAFOs for complying with the offsite certification requirements. This analysis is provided in the Development Document.

3. Cost Annualization Methodology

As part of EPA's costing analysis, EPA converts the capital costs that are estimated to be incurred by a CAFO to comply with the proposed requirements, described in Section X.C.2, to incremental annualized costs. Annualized costs better describe the actual compliance costs that a model CAFO would incur, allowing for the effects of interest, depreciation, and taxes. EPA uses these annualized costs to estimate the total annual compliance costs and to assess the economic impacts of the proposed requirements to regulated CAFOs that are presented in Sections X.E and X.F.

Additional information on the approach used to annualize the incremental compliance costs developed by EPA is provided in Appendix A of the Economic Analysis. EPA uses a 10-year recovery period of depreciable property based on the Internal Revenue Code's guidance for single purpose agricultural or horticultural structures. The Internal Revenue Service defines a single purpose agricultural structure as any enclosure or structure specifically designed, constructed and used for housing, raising, and feeding a particular kind of livestock, including structures to contain produce or equipment necessary for housing, raising, and feeding of livestock. The method EPA uses to depreciate capital investments is the Modified Accelerated Cost Recovery System (MACRS).

EPA assumes a real private discount/interest rate of 7 percent, as recommended by the Office of Management and Budget. EPA also assumes standard federal and average state tax rates across the broad facility size categories to determine an operation's tax benefit or tax shield, which is assumed as an allowance to offset taxable income.

D. Method for Estimating Economic Impacts

To estimate economic impacts under the proposed regulations, EPA examined the impacts across three industry segments: regulated CAFOs, processors, and national markets.

1. CAFO Analysis

EPA estimates the economic impacts of today's proposed regulations using a representative farm approach. A representative farm approach is consistent with past research that USDA and many land grant universities have conducted to assess a wide range of policy issues, including environmental legislation pertaining to animal agriculture. A representative farm approach provides a means to assess average impacts across numerous facilities by grouping facilities into broader categories to account for the multitude of differences among animal confinement operations. Information on how EPA developed its model CAFOs is available in the Economic Analysis. Additional information on EPA's cost models is provided in the Development Document. At various stages in the proposed rulemaking, EPA presented its proposed methodological approach to USDA personnel and to researchers at various land grant universities for informal review and feedback.

Using a representative farm approach, EPA constructed a series of model facilities that reflect the EPA's estimated compliance costs and available financial data. EPA uses these model CAFOs to develop an average characterization for a group of operations. EPA's cost models were described earlier in Section X.C.2(a). From these models, EPA estimates total annualized compliance costs by aggregating the average facility costs across all operations that are identified for a representative group. EPA's cost models are compared to corresponding model CAFOs that characterize financial conditions across differently sized, differently managed, and geographically distinct operations. As with EPA's cost models, EPA's financial models are grouped according to certain distinguishing characteristics for each sector, such as facility size and production region, that may be shared across a broad range of facilities. Economic impacts under a post-regulatory scenario are approximated by extrapolating the average impacts for a given model CAFO across the larger

number of operations that share similar production characteristics and are identified by that CAFO model.

EPA compares its estimated compliance costs at select model CAFOs to corresponding financial conditions at these model facilities. For this analysis, EPA focuses on three financial measures that are used to assess the affordability of the proposed CAFO regulations. These include total gross revenue, net cash income, and debt-to-asset ratio. Financial data used by EPA to develop its financial models are from the 1997 ARMS data summaries prepared by ERS and form the basis for the financial characterization of the model CAFOs. To account for changes in an operation's income under post-compliance conditions, EPA estimated the present value of projected facility earnings, measured as a future cash flow stream. The present value of cash flow represents the value in terms of today's dollars of a series of future receipts. EPA calculated baseline cash flow as the present value of a 10-year stream of an operation's cash flow. EPA projected future earnings from the 1997 baseline using USDA's Agricultural Baseline Projections data. Section 4 of the Economic Analysis provides additional information on the baseline financial conditions attributed to EPA's model CAFO across all sectors as well as information on the data and assumptions used to develop these models.

EPA evaluates the economic achievability of the proposed requirements based on changes in representative financial conditions for select criteria, as described in Section X.F.1. For some sectors, EPA evaluates economic impacts at model CAFOs under varying scenarios of cost passthrough between the CAFO and the latter stages in the food marketing chain, such as the processing and retail sectors. These three scenarios include: zero cost passthrough, full (100 percent) cost passthrough, and partial cost passthrough (greater than zero). Partial cost passthrough values used for this analysis vary by sector and are based on estimates of price elasticity of supply and demand reported in the academic literature. This information is available in the docket.

Table 10–1 lists the range of annualized compliance costs developed for EPA's analysis. Annualized costs for each sector are summarized across the estimated range of minimum and maximum costs across all facility sizes and production regions and are broken out by land use category (described in Section X.C.2). In some cases, ''maximum'' costs reflect average costs for a representative facility that has a large number of animals on-site; EPA's cost models for very large CAFOs are intended to approximate the average unit costs at the very largest animal feeding operations. More detailed annualized costs broken out by production region, land use category, and broad facility size groupings are provided in the Economic Analysis.

Estimated annualized costs shown in Table 10–1 are presented in 1999 dollars (post-tax). All costs presented in today's preamble have been converted using the Construction Cost Index to 1999 dollars from the 1997 dollar estimates that are presented throughout the Development Document and the Economic Analysis. As shown in the table, costs for Category 3 CAFOs may be lower than those for Category 1 CAFOs since facilities without any land do not incur any additional incremental costs related to hauling. EPA has assumed that these operations are already hauling off-site in order to comply with existing requirements. More detailed cost estimates for individual technologies are provided in the Development Document.

To assess the impact of the regulations on offsite recipients of CAFO manure, EPA compares the estimated cost of this requirement to both aggregate and average per farm production costs and revenues (a sales test). This analysis uses EPA's estimated compliance costs and 1997 aggregate farm revenues and production costs reported by USDA. For the purpose of this analysis, EPA assumes that these costs will be incurred by non-CAFO farming operations (i.e., crop producers) that use animal manures as a fertilizer substitute and will not be borne by CAFOs.

TABLE 10–1.—RANGE OF ANNUALIZED MODEL CAFO COMPLIANCE COSTS ($1999, POST-TAX)

Sector	Category 1 [1]		Category 2 [1]		Category 3 [1]	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	(1999 dollars per model CAFO across all size groups)					
Beef	2,100	986,000	8,500	1,219,800	1,000	896,700
Veal	1,500	8,100	1,100	6,100	1,000	6,000
Heifers	1,700	16,900	2,000	17,900	1,200	11,700
Dairy	5,200	44,600	14,700	67,700	4,200	40,300
Hogs: GF [2]	300	52,300	5,500	63,500	11,400	81,500
Hogs: FF [2]	300	82,900	8,800	100,600	10,000	115,500
Broilers	4,800	36,300	4,400	25,800	3,900	21,400
Layers: wet [3]	300	24,800	2,100	29,300	1,500	18,100
Layers: dry [3]	1,500	59,000	1,400	31,700	1,200	27,600
Turkeys	4,900	111,900	4,800	29,500	3,800	20,800

Source: EPA.
[1] Category 1 CAFOs have sufficient cropland for all on-farm nutrients generated; Category 2 CAFOs have insufficient cropland; and Category 3 CAFOs have no cropland.
[2] ''Hogs: FF'' are farrow-finish (includes breeder and nursery pigs); ''Hogs: GF'' are grower-finish only.
[3] ''Layers: wet'' are operations with liquid manure systems; ''Layers: dry'' are operations with dry systems.

2. Processor Analysis

As discussed in Section VI, EPA estimates that 94 meat packing plants that slaughter hogs and 270 poultry processing facilities may be subject to the proposed co-permitting requirements (Section VI). Given the structure of the beef and dairy sectors and the nature of their contract relationships, EPA expects that no meat packing or processing facilities in these sectors will be subject to the proposed co-permitting requirements. EPA bases these assumptions on data from the Department of Commerce on the number of slaughtering and meat packing facilities in these sectors and information from USDA on the degree of

animal ownership at U.S. farms, as described in Section VI of this document. Additional information is provided in Section 2 of the Economic Analysis. EPA is seeking comment on this assumption as part of today's notice.

EPA did not conduct a detailed estimate of the costs and impacts that would accrue to individual co-permittees. Information on contractual relationships between contract growers and processing firms is proprietary and EPA does not have the necessary market information and data to conduct such an analysis. Market information is not available on the number and location of firms that contract out the raising of animals to CAFOs or on the number and location of contract growers, and the share of production, that raise animals under a production contract. In addition, EPA does not have data on the exact terms of the contractual agreements between processors and CAFOs to assess when a processor would be subject to the proposed co-permitting requirements, and EPA does not have financial data for processing firms or contract growers that utilize production contracts.

EPA, however, believes that the framework used to estimate costs to CAFOs does provide a means to evaluate the possible upper bound of costs that could accrue to processing facilities in those industries where production contracts are more widely utilized and where EPA believes the proposed co-permitting requirements may affect processors. EPA's CAFO level analysis examines the potential share of (pre-tax) costs that may be passed on from the CAFO, based on market information for each sector. Assuming that a share of the costs that accrue to the CAFO are eventually borne by processors, EPA is proposing that this amount approximates the magnitude of the costs that may be incurred by processing firms in those industries that may be affected by the proposed co-permitting requirements. EPA solicits comment on this approach.

To assess the impact of the regulations on processors, EPA compares the passed through compliance costs to both aggregate processor costs of production and to revenues (a sales test). These analyses use estimated compliance costs, cost passthrough estimates, and aggregate revenues and production costs by processing sector. National processor cost and revenue data are from the U.S. Department of Commerce's Census of Manufacturers data series. For some sectors, EPA evaluates the impact of the proposed regulations on processors under two scenarios of cost passthrough from the animal production sectors (described in Section X.D.1), including full cost and partial cost passthrough. More detail on this approach is provided in Section 4 of the Economic Analysis.

This suggested approach does not assume any addition to the total costs of the rule as a result of co-permitting. This approach also does not assume that there will be a cost savings to contract growers as a result of a contractual arrangement with a processing firm. This approach merely attempts to quantify the potential magnitude of costs that could accrue to processors that may be affected by the co-permitting requirements. Due to lack of information and data, EPA has not analyzed the effect of relative market power between the contract grower and the integrator on the distribution of costs, nor the potential for additional costs to be imposed by the integrator's need to take steps to protect itself against liability and perhaps to indemnify itself against such liability through its production contracts. EPA has also not specifically analyzed the environmental effects of co-permitting. EPA has conducted an extensive review of the agricultural literature on market power in each of the livestock and poultry sectors and concluded that there is little evidence to suggest that increased production costs would be prevented from being passed on through the market levels. This information is provided in the rulemaking record. However, as discussed in Section VII.C.5, EPA recognizes that some industry representatives do not support these assumptions of cost passthrough from contract producers to integrators and requests comments on its cost passthrough assumptions, both in general and as they relate to the analysis of processor level impacts under the proposed co-permitting requirements.

EPA's processor analysis does not explicitly account for the few large corporate operations that are vertically integrated, to the extent that the corporation owns and operates all aspects of the operation, from animal production to final consumer product. These operations are covered by EPA's CAFO analysis to the extent that they are captured by USDA's farm survey and are included among EPA's model CAFOs. While the ARMS data may include information on CAFOs that are owned by corporate operations, these data cannot be broken out to create a model specifically designed to represent these operations. Since EPA's analysis uses farm financial data and not corporate data, this analysis does not reflect the ability of corporations to absorb compliance costs that may be incurred at CAFOs that are owned by that entity. EPA expects that its analysis overestimates the impact to corporate entities since revenues of corporate entities are, in most cases, no less than and are likely to exceed those at a privately-owned and operated CAFOs.

3. Market Analysis

EPA's market analysis evaluates the effects of the proposed regulations on national markets. This analysis uses a linear partial equilibrium model adapted from the COSTBEN model developed by USDA's Economic Research Service. The modified EPA model provides a means to conduct a long-run static analysis to measure the market effects of the proposed regulations in terms of predicted changes in farm and retail prices and product quantities. Market data used as inputs to this model are from a wide range of USDA data and land grant university research. EPA consulted researchers from USDA and the land grant universities in the development of this modeling framework. The details of this model are described in Appendix B of the Economic Analysis.

Once price and quantity changes are predicted by the model, EPA uses national multipliers that relate changes in sales to changes in total direct and indirect employment and also to national economic output. These estimated relationships are based on the Regional Input-Output Modeling System (RIMS II) from the U.S. Department of Commerce. This approach is described in Section 4 of the Economic Analysis.

E. Estimated Annual Costs of the Proposed Regulatory Options/Scenarios

As discussed in Section VII and VIII, EPA considered various technology options and also different scope scenarios as part of the development of today's proposed regulations. A summary overview of the ELG options and NPDES scenarios is provided in Table 10–2. More detail is available in Sections VII and VIII of today's preamble.

TABLE 10–2.—SUMMARY DESCRIPTION OF OPTIONS/SCENARIOS CONSIDERED BY EPA

Technology Options (ELG)	
Option 1	N-based land application controls and inspection and recordkeeping requirements for the production area (described in Section VIII.C.3).
Option 2	Same as Option 1, but restricts the rate of manure application to a P-based rate where necessary (depending on specific soil conditions at the CAFO).
Option 3 BAT (Beef/Heifers/Dairy)	Adds to Option 2 by requiring all operations to determine whether the groundwater beneath the production area has a direct hydrologic connection to surface water; if so, requires groundwater monitoring and controls.
Option 4	Adds to Option 3 by requiring sampling of surface waters adjacent to production area and/or land under control of the CAFO to which manure is applied.
Option 5 BAT (Swine/Poultry/Veal)	Adds to Option 2 by establishing a zero discharge requirement from the production area that does not allow for an overflow under any circumstances.
Option 6	Adds to Option 2 by requiring that large hog and dairy operations install and implement anaerobic digestion and gas combustion to treat their manure.
Option 7	Adds to Option 2 by prohibiting manure application to frozen, snow covered or saturated ground.
Regulatory Scope Options (NPDES)	
Scenario 1	Retains existing 3-tier framework and establishes additional requirements (described in Section VII.C.2).
Scenario 2	Same as Scenario 1; operations with 300–1,000 AU would be subject to the regulations based on certain ''risk-based'' conditions (described in VII.C.3.b).
Scenario 3 ''Three-Tier''	Same as Scenario 2, but allows operations with 300–1,000 AU to either apply for a NPDES permit or to certify to the permit authority that they do not meet any of the conditions and thus are not required to obtain a permit.
Scenario 4a ''Two-Tier'' (500 AU)	Establishes 2-tier framework and applies ELG standard to all operations with more than 500 AU.
Scenario 4b	Establishes 2-tier framework and applies ELG standard to all operations with more than 300 AU.
Scenario 5 ''Two-Tier'' (750 AU)	Establishes 2-tier framework and applies ELG standard to all operations with more than 750 AU.
Scenario 6	Retains existing 3-tier framework and establishes a simplified certification process (described in Section VII.C.2).

The ''BAT Option'' refers to EPA's proposal to require nitrogen-based and, where necessary, phosphorus-based land application controls of all livestock and poultry CAFOs (Option 2), with the additional requirement that all cattle and dairy operations must conduct groundwater monitoring and implement controls, if the groundwater beneath the production area has a direct hydrologic connection to surface water (Option 3 BAT), and with the additional requirement that all hog, veal, and poultry CAFOs must also achieve zero discharge from the animal production area with no exception for storm events (Option 5 BAT). For reasons outlined in Section VIII, EPA is not proposing that beef and dairy CAFOs meet the additional requirements under Option 5 or that hog and poultry CAFOs meet the additional requirements under Option 3. Section VIII discusses EPA's basis for the selection of these technology bases for the affected subcateogries.

EPA is jointly proposing two NPDES Scenarios that differ in terms of the manner in which operations are defined as a CAFO. Scenario 4a is to the two-tier alternative that defines as CAFOs all animal feeding operations with more than 500 AU (alternatively, Scenario 5 is the two-tier alternative that defines all animal feeding operations with more than 750 AU as CAFOs). Scenario 3 is three-tier structure that defines as CAFOs all animal feeding operations with more than 1,000 AU and any operation with more than 300 AU, if they meet certain ''risk-based'' conditions, as defined in Section VII. Under Scenario 3, EPA would require all confinement operations with between 300 and 1,000 AU to either apply for a NPDES permit or to certify to the permit authority that they do not meet certain conditions and thus are not required to obtain a permit.

For the purpose of this discussion, the ''two-tier structure'' refers to the combination of BAT Option 3 (beef and dairy subcategories) and BAT Option 5 (swine and poultry subcategories), and NPDES Scenario 4a that covers all operations with more than 500 AU. Where indicated, the two-tier structure may refer to the alternative threshold at 750 AU. The ''three-tier structure'' refers to the combination of ELG Option 3 (beef and dairy subcategories) and Option 5 (swine and poultry subcategories), and NPDES Scenario 3 that covers operations down to 300 AU based on certain conditions. More detail of the technology options considered by EPA is provided in Section VIII. Section VII of this preamble provides additional information on the alternative scope scenarios considered by EPA. EPA did not evaluate costs and economic impacts under the alternative three-tier structure that combines the BAT Option with Scenario 6, as described in Table 10–2.

Under the two-tier structure, EPA estimate that 25,540 CAFOs with more than 500 AU may be defined as CAFOs and subject to the proposed regulations. EPA estimates that 19,100 CAFOs may be defined as CAFOs under the alternative two-tier threshold of 750 AU. Under the three-tier structure, an estimated 31,930 CAFOs would be defined as CAFOs (Table 6–2) and an additional 7,400 operations in the 300 to 1,000 AU size range would need to certify that they do not need to apply for a permit. This total estimate counts operations with more than a single animal type only once. EPA's analysis computes total compliance costs based on the total number of CAFOs in each sector, including mixed operations that have more than 300 or 500 AU of at least one animal type. This approach avoids understating costs at operations with more than one animal type that may incur costs to comply with the proposed requirements for each type of animal that is raised on-site that meets the size threshold for a CAFO or is designated as a CAFO by the permitting authority. Therefore, EPA's compliance costs estimates likely represent the upper bound since costs at facilities with more than a single animal type may, in some cases, be lower due to shared production technologies and practices across all animal types that are produced on-site.

1. Costs to CAFOs Under the Proposed Regulations

Tables 10–3 and 10–4 summarize the total annualized compliance costs to CAFOs attributed to the proposed two-tier structure and three-tier structure. The table shows these costs broken out by sector and by broad facility size group. EPA calculated all estimated costs using the data, methodology and assumptions described in Sections X.B and X.C.

Under the two-tier structure, EPA estimates that the incremental annualized compliance cost to CAFO operators would be approximately $831 million annually (Table 10–3). Table 10–5 shows estimated costs for the two-tier structure at the 750 AU threshold, estimated by EPA to total $721 million annually. Most of this cost (roughly 70 percent) is incurred by CAFOs with more than 1,000 AU. Overall, about one-third of all estimated compliance costs are incurred within the hog sectors.

Under the three-tier structure, EPA estimates that the total cost to CAFO operators would be $925 million annually (Table 10–4). These costs are expressed in terms of pre-tax 1999 dollars. (Post-tax costs are estimated at $573 million and $635 million annually, respectively, and include tax savings to CAFOs. EPA uses estimated post-tax costs to evaluate impacts to regulated facilities, discussed in Section X.F.). Estimated total annualized costs for the three-tier structure include the cost to permitted CAFOs as well as the estimated cost to operations to certify to the permit authority that they do not meet any of the conditions and are thus are not required to obtain a permit. EPA estimates certification costs at about $80 million annually, which covers phosphorus-based PNP costs, facility upgrades, and letters of certification from manure recipient. More information on these costs and how they are calculated is provided in Section 5 of the Economic Analysis.

Estimated total annualized costs shown in Table 10–3 and 10–4 include costs to animal confinement operations that may be designated as CAFOs. Total annualized costs to designated facilities is estimated at less than one million dollars annually (Tables 10–3 and 10–4). As discussed in Section VI, EPA assumes that designation may bring an additional 50 operations each year under the two-tier structure; under the three-tier structure, EPA expects that an additional 10 operations may be designated each year. In this analysis, estimated costs to designated facilities are expressed on an average annual basis over a projected 10-year period. For the purpose of this analysis, EPA assumes that operations that may be designated as CAFOs and subject to the proposed regulations will consist of beef, dairy, farrow-finish hog, broiler and egg laying operations under the two-tier structure. Under the three-tier structure, EPA estimates that fewer operations would be designated as CAFOs, with 10 dairy and hog operations being designated each year, or 100 operations over a 10-year period. Additional information is provided in the Economic Analysis.

TABLE 10–3.—ANNUAL PRE-TAX COST OF TWO-TIER STRUCTURE (BAT OPTION/SCENARIO 4A), $1999

Sector	Number of operations	Total	>1000 AU	500–1000 AU	<500 AU [1]
	(number) [2]	($1999, millions, pre-tax)			
Regulated CAFOs					
Beef	3,080	216.4	191.5	24.7	0.1
Veal	90	0.3	0.03	0.3	NA
Heifer	800	11.6	3.7	7.9	NA
Dairy	3,760	177.6	108.6	65.4	3.6
Hog	8,550	294.0	225.5	67.0	1.5
Broiler	9,780	97.1	55.4	41.6	0.1
Layer	1,640	14.2	9.9	4.3	NA
Turkey	1,280	19.6	10.4	9.2	NA
Subtotal	25,540	830.7	605.0	220.2	5.4
Other Farming Operations					
Offsite Recipients	17,923	9.6	NA	NA	NA
Total	NA	840.3	NA	NA	NA

Source: USEPA. See Economic Analysis. Table 6–2 provides information on affected operations.
Numbers may not add due to rounding. NA = Not Applicable. Option/Scenario definitions provided in Table 10–2.
[1] Cost estimates shown are for designated CAFOs (see Section VI).
[2] ''Total'' adjusts for operations with more than a single animal type. The number of CAFOs shown includes expected defined CAFOs only and excludes designated facilities.

TABLE 10–4.—ANNUAL PRE-TAX COST OF THREE-TIER STRUCTURE (BAT OPTION/SCENARIO 3), $1999

Sector	Number of operations	Total	>1000 AU	300–1000 AU	<300 AU [1]
	(number) [2]	($1999, million, pre-tax)			
Regulated CAFOs					
Beef	3,210	227.7	191.5	36.2	0.0
Veal	140	0.8	0.03	0.8	0.0
Heifer	980	14.4	3.7	10.7	0.0
Dairy	6,480	224.6	108.6	115.3	0.7
Hog	8,350	306.1	225.5	80.4	0.2

TABLE 10–4.—ANNUAL PRE-TAX COST OF THREE-TIER STRUCTURE (BAT OPTION/SCENARIO 3), $1999—Continued

Sector	Number of operations	Total	>1000 AU	300–1000 AU	<300 AU [1]
Broiler	13,740	116.6	55.4	61.2	0.0
Layer	2,010	15.3	9.9	5.4	0.0
Turkey	2,060	24.9	10.4	14.5	0.0
Subtotal	31,930	930.4	605.0	324.5	0.8
Other Farming Operations					
Offsite Recipients	21,155	11.3	NA	NA	NA
Total	NA	936.7	NA	NA	NA

Source: USEPA. See Economic Analysis. Table 6–2 provides information on affected operations.
Numbers may not add due to rounding. NA = Not Applicable. Option/Scenario definitions provided in Table 10–2.
[1] Cost estimates shown are for designated CAFOs (see Section VI).
[2] ''Total'' adjusts for operations with more than a single animal type. The number of CAFOs shown includes expected defined CAFOs only and excludes designated facilities.

2. Costs to CAFOs of Alternative Regulatory Options and Scenarios

Alternative regulatory options considered by EPA during the development of today's proposed regulations include various technology options and also different regulatory scope scenarios. Sections VII and VIII present the Agency's rationale for each regulatory decision.

Table 10–5 summarizes the total annualized (pre-tax) costs of alternative technology options for each NPDES scenario and ELG technology basis considered by EPA. As shown in the table, the total estimated costs across these options range from $355 million (Option 1/Scenario 1) to $1.7 billion annually (Option 5, applicable to all the animal sectors, and Scenario 4b). By scenario, this reflects the fact that fewer CAFOs would be affected under Scenario 1 (a total of about 16,400 operations) as compared to Scenario 4b (about 39,300 operations affected). As noted in Section X.E, EPA's estimate of the number of CAFOs and corresponding compliance costs does not adjust for operations with mixed animal types and may be overstated. By technology option, with the exception of Options 1 and 4, costs are evaluated incremental to Option 2 (see Table 10–2). Compared to Option 2, Option 5 costs are greatest. Additional breakout of these costs by sector are provided in the Economic Analysis.

TABLE 10–5.—ANNUALIZED PRE-TAX COSTS FOR THE ALTERNATIVE NPDES SCENARIOS ($1999, MILLION)

Option/Scenario	Scenario 4a ''Two-Tier''	Scenaro 2/3 ''Three-Tier''	Scenario 1	Scenario 5 >750 AU	Scenario 4b >300 AU
Number of CAFOs [1]	25,540	28,860	16,420	25,770	39,320
Option 1	$432.1	$462.8	$354.6	$384.3	$493.6
Option 2	$548.8	$582.8	$444.4	$484.0	$633.3
Option 3	$746.7	$854.1	$587.0	$649.5	$883.6
Option 4	$903.9	$1,088.2	$707.0	$768.0	$1,121.2
Option 5	$1,515.9	$1,632.9	$1,340.9	$1,390.4	$1,671.3
Option 6	$621.6	$736.9	$501.5	$541.3	$706.6
Option 7	$671.3	$781.9	$542.4	$585.1	$756.6
BAT Option	$830.7	$925.1	$680.3	$720.8	$979.6

Source: USEPA. See Economic Analysis. Cost estimates shown include costs to designated operations.
Numbers may not add due to rounding. NA = Not Applicable. Option/Scenario definitions provided in Table 10–2.
[1] ''Total'' adjusts for operations with more than a single animal type. The number of CAFOs shown includes expected defined CAFOs only and excludes designated facilities.

3. Costs to Offsite Recipients of CAFO Manure Under the Proposed Regulations

As described in Section VII, EPA is proposing that offsite recipients of CAFO manure certify to the CAFO that manure will be land applied in accordance with proper agriculture practices. As shown in Table 10–3, EPA estimates that 18,000 non-CAFO farming operations will receive manure and therefore be required to certify proper manure utilization under the proposed two-tier structure. Under the alternative three-tier structure, up to 3,000 additional farming operations may be affected. EPA's analysis assumes that affected CAFO manure recipients are mostly field crop producers who use CAFO manure as a fertilizer substitute. EPA's analysis does not reflect manure hauled offsite for alternative uses such as incineration or pelletizing. EPA estimates the annualized cost of this requirement to offsite recipients to be $9.6 to $11.3 million across the co-proposed alternatives (Tables 10–3 and 10–4). This analysis is provided in the Development Document.

Estimated costs to recipients of CAFO manure include incremental recordkeeping and soil tests every 3 years. Conservation Technology Information Center (CTIC) Core 4 survey data suggest an average of 46 percent crop farmers regularly sample their soil. EPA believes crop farmers already maintain records pertaining to crop yields, nutrient requirements, and fertilizer applications. EPA also assumed that crop farmers have a nutrient management plan, though the plan is not necessarily a PNP (Permit Nutrient Plan) or CNMP (Comprehensive Nutrient Management Plan). EPA has evaluated alternative

approaches to ensuring that manure is handled properly, but is not proposing to establish specific requirements for offsite recipients. The costs to offsite recipients do not include the costs of spreading manure at the offsite location or any additional payments made to brokers or manure recipients in counties with excess manure. These costs are likely to be offset by the fertilizer savings and organic value associated with manure. EPA's analysis accounts for the costs incurred by the CAFO for offsite transfer of excess manure in the estimated industry compliance costs, described in Section X.E.1. These costs include the cost of soil and manure sampling at the CAFO site, training for manure applicators, application equipment calibration, and the hauling cost of excess manure generated by the CAFO.

Under the proposed regulations, CAFOs would be required to apply manure on a phosphorus basis where necessary, based on soil conditions, and on a nitrogen basis elsewhere. EPA anticipates that offsite recipients of CAFO manure will only accept manure when soil conditions allow for application on a nitrogen basis. EPA believes this is a reasonable assumption because crop farms are less likely to have a phosphorus buildup associated with long term application of manure. EPA's analysis assumes a nitrogen-based application rate for offsite locations that is identical to the rate used by CAFOs in the same geographic region. A summary of the data and methodology used by EPA to calculate the number of affected offsite recipients and to estimate costs is presented in Section X.C.2(b). EPA solicits comment on the costs and assumptions pertaining to offsite recipients.

F. Estimated Economic Impacts of the Proposed Regulatory Options/Scenarios

This section provides an overview of EPA's estimated economic impacts across four industry segments that are included for this analysis: CAFOs (both existing and new sources), non-CAFO recipients of manure, processors, and consumer markets. More detailed information on each of these analyses is available in the Economic Analysis.

1. CAFO Level Analysis

This section presents EPA's analysis of financial impacts to both existing and new CAFOs that will be affected by the proposed regulations, as well as impacts to offsite recipients of CAFO manure who will also be required to comply with the proposed PNP requirements.

a. *Economic Impacts to Existing CAFOs under the Proposed Regulations.* As discussed in Section X.C.1, EPA's CAFO level analysis examines compliance cost impacts for a representative ''model CAFO.'' EPA evaluates the economic achievability of the proposed regulatory options at existing animal feeding operations based on changes in representative financial conditions across three criteria. These criteria are: a comparison of incremental costs to total revenue (sales test), projected post-compliance cash flow over a 10-year period, and an assessment of an operation's debt-to-asset ratio under a post-compliance scenario. To evaluate economic impacts to CAFOs in some sectors, impacts are evaluated two ways'assuming that a portion of the costs may be passed on from the CAFO to the consumer and assuming that no costs passthrough so that all costs are absorbed by the CAFO.

EPA used the financial criteria to divide the impacts of the proposed regulations into three impact categories. The first category is the affordable category, which means that the regulations have little or no financial impact on CAFO operations. The second category is the moderate impact category, which means that the regulations will have some financial impact on operations at the affected CAFOs, but EPA does not consider these operations to be vulnerable to closure as a result of compliance. The third category is the financial stress category, which means that EPA considers these operations to be vulnerable to closure post-compliance. More information on these criteria is provided in Section 4 of the Economic Analysis.

The basis for EPA's economic achievability criteria for this rulemaking is as follows. USDA's financial classification of U.S. farms identifies an operation with negative income and a debt-asset ratio in excess of 40 percent as ''vulnerable.'' An operation with positive income and a debt-asset ratio of less than 40 percent is considered ''favorable.'' EPA adopted this classification scheme as part of its economic achievability criteria, using net cash flow to represent income. This threshold and cash flow criterion is established by USDA and other land grant universities, as further described in Section 4 of the Economic Analysis. The threshold values used for the cost-to-sales test (3 percent, 5 percent and 10 percent) are those determined by EPA to be appropriate for this rulemaking and are consistent with threshold levels used by EPA to measure impacts of regulations for other point source dischargers (as also documented in the Economic Analysis).

For this analysis, EPA's determination of economic achievability used all three criteria. EPA considered the proposed regulations to be economically achievable for a representative model CAFO if the average operation has a post-compliance sales test estimate within an acceptable range, positive post-compliance cash flow over a 10-year period, and a post-compliance debt-to-asset ratio not exceeding 40 percent. If the sales test shows that compliance costs are less than 3 percent of sales, or if post-compliance cash flow is positive and the post-compliance debt-to-asset ratio does not exceed 40 percent and compliance costs are less than 5 percent of sales, EPA considers the options to be ''Affordable'' for the representative CAFO group. A sales test of greater than 5 percent but less than 10 percent of sales with positive cash flow and a debt-to-asset ratio of less than 40 percent is considered indicative of some impact at the CAFO level, but at levels not as severe as those indicative of financial distress or vulnerability to closure. These impacts are labeled ''Moderate'' for the representative CAFO group. EPA considers both the ''Affordable'' and ''Moderate'' impact categories to be economically achievable by the CAFO.

If (with a sales test of greater than 3 percent) post-compliance cash flow is negative or the post-compliance debt-to-asset ratio exceeds 40 percent, or if the sales test shows costs equal to or exceeding 10 percent of sales, the proposed regulations are estimated to be associated with potential financial stress for the entire representative CAFO group. In such cases, each of the operations represented by that group may be vulnerable to closure. These impacts are labeled as ''Stress.'' EPA considers the ''Stress'' impact category to indicate that the proposed requirements may not be economically achievable by the CAFO, subject to other considerations.

Tables 10–6 and 10–7 present the estimated CAFO level impacts in terms of the number of operations that fall within the affordable, moderate, or stress impact categories for each of the co-proposed alternatives by sector and facility size group. For some sectors, impacts are shown for both the zero and the partial cost passthrough assumptions (discussed more fully below). Partial cost passthrough values vary by sector, as described in Section X.D.1.

EPA's costs model analyzes impacts under two sets of conditions for ELG Option 3. Option 3A assumes that there is a hydrologic connection from groundwater to surface waters at the

CAFO; Option 3 assumes average costs conditions across all operations—both operations with and without a hydrologic link. Based on available data and information, EPA's analysis assumes 24 percent of the affected operations have a hydrologic connection to surface waters. More detail on this assumption may be found in the rulemaking record. EPA solicits comment on this assumption as part of today's proposed rulemaking.

Based on results shown in Tables 10–6 and 10–7, EPA proposes that the regulatory alternatives are economically achievable for all representative model CAFOs in the veal, turkey and egg laying sectors. The proposed requirements under the two-tier structure are also expected to be economically achievable by all affected heifer operations. Furthermore, although operations across most sectors may experience moderate impacts, EPA does not expect moderate financial impacts to result in closure and considers this level of impact to be economically achievable.

In the beef cattle, heifer, dairy, hog and broiler sectors, however, EPA's analysis indicates that the proposed regulations will cause some operations to experience financial stress, assuming no cost passthrough. These operations may be vulnerable to closure by complying with the proposed regulations. Across all sectors, an estimated 1,890 operations would experience financial stress under the two-tier structure and an estimated 2,410 operations would experience stress under the three-tier structure. For both tier structures, EPA estimates that the percentage of operations that would experience impacts under the stress category represent 7 percent of all affected CAFOs or 8 percent of all affected operations in the sectors where impacts are estimated to cause financial stress (cattle, dairy, hog, and broiler sectors).

Tables 10–6 shows results for the two-tier structure at the 500 AU threshold. By sector, EPA estimates that 1,420 hog operations (17 percent of affected hog CAFOs), 320 dairies (9 percent of operations), 150 broiler operations (2 percent), and 10 beef operations (less than 1 percent) would experience financial stress. The broiler and hog operations with these impacts have more than 1,000 AU on-site (i.e., no operations with between 500 and 1,000 AU fall in the stress category). The dairy and cattle operations with stress impacts are those that have a ground water link to surface water. Although not presented here, the results of the two-tier structure at the 750 AU threshold are very similar in terms of number of operations affected. The results of this analysis are presented in the Economic Analysis.

Table 10–7 presents results for the three-tier structure, and show that 1,420 hog operations (17 percent of affected hog CAFOs under that alternative), 610 dairies (9 percent of operations), 330 broiler operations (2 percent), and 50 beef and heifer operations (1 percent) will be adversely impacted. Hog operations with stress impacts all have more than 1,000 AU. Affected broiler facilities include operations with more than 1,000 AU, as well as operations with less than 1,000 AU. Dairy and cattle operations in the stress category are operations that have a hydrologic link from ground water to surface water. Based on these results, EPA is proposing that the proposed regulations are economically achievable.

In the hog and broiler sectors, EPA also evaluated financial impacts with an assumption of cost passthrough. For the purpose of this analysis, EPA assumes that the hog sector could passthrough 46 percent of compliance costs and the broiler sector could passthrough 35 percent of compliance costs. EPA derived these estimates from price elasticities of supply and demand for each sector reported in the academic literature. More detailed information is provided in Section 4 and Appendix C of the Economic Analysis. Assuming these levels of cost passthrough in these sectors, the magnitude of the estimated impacts decreases to the affordable or moderate impact category. Even in light of the uncertainty of cost passthrough (both in terms of whether the operations are able to pass cost increases up the marketing chain and the amount of any cost passthrough), EPA proposes that the proposed regulations will be economically achievable to all hog and broiler operations.

Although EPA's analysis does not consider cost passthrough among cattle or dairy operations, EPA does expect that long-run market and structural adjustment by producers in this sector will diminish the estimated impacts. However, EPA did determine that an evaluation of economic impacts to dairy producers would require that EPA assume cost passthrough levels in excess of 50 percent before operations in the financial stress category would, instead, fall into the affordable or moderate impact category. EPA did not conduct a similar evaluation of estimated impacts to beef cattle and heifer operations.

EPA believes that the assumptions of cost passthrough are appropriate for the pork and poultry sectors. As discussed in Section VI, EPA expects that meat packing plants and slaughtering facilities in the pork and poultry industries may be affected by the proposed co-permitting requirements in today's proposed regulations. Given the efficiency of integration and closer producer-processor linkages, the processor has an incentive to ensure a continued production by contract growers. EPA expects that these operations will be able to pass on a portion of all incurred compliance costs and will, thus, more easily absorb the costs associated with today's proposed rule. This passthrough may be achieved either through higher contract prices or through processor-subsidized centralized off-site or on-site waste treatment and/or development of marketable uses for manure.

EPA recognizes, however, that some industry representatives do not support assumptions of cost passthrough from contract producers to integrators, as also noted by many small entity representatives during the SBREFA outreach process as well as by members of the SBAR Panel. These commenters have noted that integrators have a bargaining advantage in negotiating contracts, which may ultimately allow them to force producers to incur all compliance costs as well as allow them to pass any additional costs down to growers that may be incurred by the processing firm. To examine this issue, EPA conducted an extensive review of the agricultural literature on market power in each of the livestock and poultry sectors and concluded that there is little evidence to suggest that increased production costs would be prevented from being passed on through the market levels. This information is provided in the rulemaking record. Given the uncertainty of whether costs will be passed on, EPA's results are presented assuming some degree of cost passthrough and also no cost passthrough (*i.e.*, the highest level of impacts projected). EPA requests comment on its cost passthrough assumptions. Although EPA does consider the results of both of these analyses in making its determination of economic achievability, EPA's overall conclusions do not rely on assumptions of cost passthrough.

Finally, EPA believes its estimated impacts may be overstated since the analysis does not quantify various cost offsets that are available to most operations. One source of potential cost offset is cost share and technical assistance available to operators for on-site improvements that are available from various state and federal programs, such as the Environmental Quality

Incentives Program (EQIP) administered by USDA. Another source of cost offset is revenue from manure sales, particularly of relatively higher value dry poultry litter. EPA's analysis does not account for these possible sources of cost offsets because the amount of cost offset is likely variable among facilities, depending on certain site-specific conditions. If EPA were to quantify the potential cost offsets as part of its analysis, this would further support EPA's proposed determination that the proposed requirements are economically achievable to affected operations. This analysis and additional supporting documentation is provided in Section 6 of the Economic Analysis.

Appendix D of the Economic Analysis provides results of sensitivity analyses, conducted by EPA, to examine the impact under differing model assumptions. This analysis examines the change in the modeling results from varying the baseline assumptions on gross and net cash income, debt-to-asset ratios as well as other variability factors for model CAFOs. These sensitivity analyses conclude that the results presented here are stable across a range of possible modeling assumptions. EPA also conducted sensitivity analysis of the compliance costs developed for the purpose of estimating CAFO level impacts, as documented in the Development Document.

TABLE 10–6.—IMPACTED OPERATIONS UNDER THE TWO-TIER STRUCTURE (BAT OPTION/SCENARIO 4A)

Sector	Number of CAFOs	(Number of affected operations)					
		Zero cost passthrough			Partial cost passthrough		
		Affordable	Moderate	Stress	Affordable	Moderate	Stress
Fed Cattle	3,080	2,830	240	10	ND	ND	ND
Veal	90	90	0	0	ND	ND	ND
Heifer	800	680	120	0	ND	ND	ND
Dairy	3,760	3,240	200	320	ND	ND	ND
Hogs: GF [1]	2,690	1,710	180	810	2,690	0	0
Hogs: FF [1]	5,860	5,210	30	610	5,860	0	0
Broilers [4]	9,780	1,960	7,670	150	8,610	1,170	0
Layers—Wet [2]	360	360	0	0	ND	ND	ND
Layers—Dry [2]	1,280	1,280	0	0	ND	ND	ND
Turkeys	1,280	1,230	50	0	ND	ND	ND
Total [3]	28,970	18, 580	8,490	1,890	26,840	1,800	330

Source: USEPA. See Economic Analysis. Impact estimates shown include impacts to designated operations.
Numbers may not add due to rounding. ND=Not Determined. Option/Scenario definitions provided in Table 10–2.
Category definitions (''Affordable,'' ''Moderate'' and ''Stress'') are provided in Section X.F.1.
[1] ''Hogs: FF'' are farrow-finish (includes breeder and nursery pigs); ''Hogs: GF'' are grower-finish only.
[2] ''Layers: wet'' are operations with liquid manure systems; ''Layers: dry'' are operations with dry systems.
[3] ''Total'' does not adjust for operations with mixed animal types, for comparison purposes, to avoid understating costs at operations with more than one animal type that may incur costs to comply with the proposed requirements for each type of animal that is raised on-site.

TABLE 10–7.—IMPACTED OPERATIONS UNDER THE THREE-TIER STRUCTURE (BAT OPTION/SCENARIO 3)

Sector	Number of CAFOs	(Number of affected operations)					
		Zero cost passthrough			Partial cost passthrough		
		Affordable	Moderate	Stress	Affordable	Moderate	Stress
Fed Cattle	3,210	2,540	650	20	ND	ND	ND
Veal	140	140	0	0	ND	ND	ND
Heifer	980	800	150	30	ND	ND	ND
Dairy	6,480	5,300	560	610	ND	ND	ND
Hogs: GF [2]	2,650	1,660	190	810	2,650	0	0
Hogs: FF [1]	5,710	5,070	30	610	5,710	0	0
Broilers	13,740	1,850	11,560	330	12,320	1,440	0
Layers—Wet [2]	360	360	0	0	ND	ND	ND
Layers—Dry [2]	1,660	1,660	0	0	ND	ND	ND
Turkeys	2,060	1,950	110	0	ND	ND	ND
Total [3]	37,000	21,300	13,250	2,410	33,410	2,930	660

Source: USEPA. See Economic Analysis. Impact estimates shown include impacts to designated operations.
Numbers may not add due to rounding. ND=Not Determined. Option/Scenario definitions provided in Table 10–2.
Category definitions (''Affordable,'' ''Moderate'' and ''Stress'') are provided in Section X.F.1.
[1] ''Hogs: FF'' are farrow-finish (includes breeder and nursery pigs); ''Hogs: GF'' are grower-finish only.
[2] ''Layers: wet'' are operations with liquid manure systems; ''Layers: dry'' are operations with dry systems.
[3] ''Total'' does not adjust for operations with mixed animal types, for comparison purposes, to avoid understating costs at operations with more than one animal type that may incur costs to comply with the proposed requirements for each type of animal that is raised on-site.

b. *Economic Impacts to Existing CAFOs under Alternative Regulatory Options and Scenarios.* Table 10–8 presents estimated financial stress impacts to model CAFOs under alternative option and scenario combinations, assuming that no costs passthrough. The results shown are aggregated and combine impacts in the cattle sector (including all beef, veal and heifer operations), hog sector (including all phases of production), and poultry

sector (including all broiler, egg laying and turkey operations). Results are shown for Scenario 4a (two-tier), Scenario 3 (three-tier), and Scenario 4b. Results are shown for technology Options 1 through 5. Additional information is available in the Economic Analysis that supports today's rulemaking.

As shown in Table 10–8, the number of potential closures range from 610 operations (Option 1 in combination with all Scenarios) to more than 14,000 potential closures (Option 4/Scenario 4b). Among options, the number of possible closures are highest under the more stringent options, including Options 3A (i.e., requires groundwater controls at operations where there is a determined groundwater hydrologic connection to surface waters), Option 4 (groundwater controls and surface water sampling), and Option 5 (i.e., zero discharge from the animal production area with no exception for storm events). Differences across scenarios reflects differences in the number of affected operations; accordingly, the number of closures is greatest under Scenario 4b that would define as CAFOs all confinement operations with more than 300 AU.

TABLE 10–8.—''STRESS'' IMPACTS AT CAFOS UNDER ALTERNATIVE OPTIONS/SCENARIOS

Sector	Number of CAFOs	(Number of operations)						
		Option 1	Option 2	Option 3	Option 3A [1]	Option 4	Option 5	BAT option
BAT Option/NPDES Scenario 4a (>500 AU)								
Cattle	3,960	0	0	0	10	0	30	10
Dairy	3,760	0	0	0	320	0	0	320
Hogs	8,550	610	300	230	310	570	1,420	1,420
Poultry	12,700	0	150	260	100	6,660	150	150
Total [2]	28,970	610	450	490	730	7,230	1,590	1,890
BAT Option/NPDES Scenario 4b (>300 AU)								
Cattle	5,330	0	0	0	90	30	180	90
Dairy	7,140	0	0	0	700	0	0	700
Hogs	14,370	610	300	230	330	570	1,420	1,420
Poultry	18,300	0	320	470	380	11,030	320	320
Total [2]	45,140	610	620	700	1,500	11,630	1,910	2,530
BAT Option/NPDES Scenario 3 (>300 AU with certification)								
Cattle	4,330	0	0	0	50	0	100	50
Dairy	6,480	0	0	0	610	0	0	610
Hogs	8,360	610	300	230	320	570	1,420	1,420
Poultry	17,830	0	330	470	370	10,740	330	330
Total [2]	37,000	610	630	700	1,350	11,310	1,850	2,410

Source: USEPA. See Economic Analysis. Impact estimates shown include impacts to designated operations.
Numbers may not add due to rounding. ND = Not Determined. Option/Scenario definitions provided in Table 10–2.
[1] Option 3A impacts reflect operations where there is a determined groundwater hydrologic connection to surface waters (assumed at 24 percent of the affected operations).
[2] ''Total'' does not adjust for operations with mixed animal types, for comparison purposes, to avoid understating costs at operations with more than one animal type that may incur costs to comply with the proposed requirements for each type of animal that is raised on-site. The number of CAFOs shown includes expected defined CAFOs only and excludes designated facilities.

c. *Economic Analysis of New CAFOs from NSPS under the Proposed Regulations.* For new sources, EPA is proposing that operations meet performance standards, as specified by the BAT requirements (Option 3 NSPS, beef and dairy subcategories, and Option 5 NSPS, swine and poultry subcategories), with the additional requirement that all new hog and poultry operations also implement groundwater controls where there is a hydrologic link to surface water (Option 3 NSPS, swine and poultry subcategories). Additional information on new source requirements is provided in Section VIII of this document.

In general, EPA believes that new CAFOs will be able to comply at costs that are similar to, or less than, the costs for existing sources, because new sources can apply control technologies more efficiently than sources that need to retrofit for those technologies. New sources will be able to avoid these costs that will be incurred by existing sources. Furthermore, EPA believes that new sources can avoid the costs associated with ground water protection through careful site selection. There is nothing about today's proposal that would give existing operators a cost advantage over new feedlot operators; therefore, new source standards are not expected to present a barrier to entry for new facilities.

EPA's analysis of the NSPS costs indicate that requiring Option 3 for new sources in the beef and dairy subcategories and both Option 3 NSPS and Option 5 NSPS for the swine and poultry subcategories (''Option 5+3 NSPS'') would be affordable and would not create any barriers to entry into those sectors. The basis for this determination is as follows. Option 5+3 NSPS is considered equivalent to Option 5 for new sources in terms of cost. EPA is proposing that Option 3 NSPS for beef and dairy subcategories and Option 5 NSPS for swine and poultry subcategories is economically achievable for existing sources. Since the estimated costs for these options are the same as or less expensive than costs for these same options for existing sources, no barriers to entry are created.

Under Option 5+3 NSPS, costs for new sources in the swine and poultry subcategories would be the same as or

less than those for equivalent existing sources (BAT under Option 5), as long as new sources are not sited in areas where there is a hydrologic link to surface water. New operations are not expected to incur costs estimated under Option 3A, which includes groundwater controls, since they are not likely to establish a new operation where there is a hydrologic link to surface waters (and where operating expenses would be more costly). Thus EPA assumes that the costs for Option 5+3 NSPS are the same as those for Option 5 NSPS, which in turn are the same as those for Option 5 BAT. EPA is proposing that Option 5 BAT is economically achievable for existing sources in the swine and poultry subcategories and therefore this same option should be affordable to new sources. Furthermore, because costs to new sources for meeting Option 5 NSPS are no more expensive than the costs for existing sources to meet Option 5 BAT, there should be no barriers to entry.

The estimated costs of Option 3 NSPS for the beef and dairy subcategories are the same as or less than the costs for Option 3 BAT, which includes retrofitting costs. EPA is proposing that Option 3 BAT is economically achievable for existing sources in these sectors. Since Option 3 NSPS is no more expensive than Option 3 BAT, this option should also be economically achievable for new sources and should not create any barriers to entry. In fact, new sources may be able to avoid the cost of implementing groundwater controls through careful site selection, thus their costs may be substantially lower than similar existing sources.

EPA did not consider an option similar to Option 5+3 NSPS for the beef and dairy subcategories (Option 8 NSPS), but found this option to be substantially more expensive than Option 3 BAT for the dairy sector and could create barriers to entry for this sector. Therefore, EPA rejected this option. See Section 5 of the Economic Analysis for more details on these analyses.

d. *Economic Impacts to Offsite Recipients of CAFO Manure of the Proposed Regulations.* As discussed in Section X.D.1, EPA assesses the economic impact to offsite recipients of CAFO manure by comparing the estimated cost of this requirement to both aggregate and average per-farm production costs and revenues. For the purpose of this analysis, EPA assumes that these regulatory costs will be borne by a non-CAFO farming operation that uses animal manures as a fertilizer substitute.

EPA estimates that 17,900 to 21,200 farming operations will incur $9.6 million to $11.3 million in costs associated with requirements for the offsite transfer of CAFO manure (Tables 10–3 and Table 10–4). This translates to an average cost of roughly $540 per recipient. As reported by USDA, farm production expenses in 1997 totaled $150.6 billion nationwide. Revenue from farm sales totaled $196.9 billion. Averaged across the total number of farms, average per-farm costs and revenues were $78,800 and $113,000 in 1997, respectively. Using these data, the ratio of incremental costs to offsite recipients as a share of average operating expenses and average farm revenue is well under one percent. Total estimated compliance costs ($9.6 million to $11.3 million annually) as a share of aggregate farm expenses and sales is also under one percent. This analysis is provided in Section 5 of the Economic Analysis.

2. Processor Level Analysis

As discussed in Section X.D.2, EPA did not conduct a detailed estimate of the costs and impacts that would accrue to individual co-permittees due to lack of data and market information. However, EPA believes that the framework used to estimate costs to CAFO provides a means to evaluate the possible upper bound of costs that could accrue to potential co-permittees, based on the potential share of (pre-tax) costs that may be passed on from the CAFO (described in Section X.D.2). EPA is proposing that this amount approximates the magnitude of the costs that may be incurred by processing firms in those industries that may be affected by the proposed co-permitting requirements.

Table 10–9 presents the results of EPA's analysis. This analysis focuses on the potential magnitude of costs to co-permittees in the pork and poultry sectors only since these are the sectors where the proposed co-permitting requirements could affect processing facilities. However, EPA did not evaluate the potential magnitude of costs to egg and turkey processors because the compliance costs to CAFOs in these industries is projected to be easily absorbed by CAFOs (see Section X.F.1). The results presented in Table 10–9 are for the pork and broiler industries only. EPA also did not evaluate the potential costs to cattle and dairy processors because EPA does not expect that the proposed co-permitting requirements to affect meat packing and processing facilities in these industries, for reasons outlined in Section VI.

The potential magnitude of costs to co-permittees is derived from the amount of cost passthrough assumed in the CAFO level analysis, described in Section X.F.1. For this analysis, two scenarios of cost passthrough to processors are evaluated: partial cost passthrough (greater than zero) and also 100 percent cost passthrough. EPA's partial cost passthrough scenario assumes that 46 percent of all hog compliance costs and that 35 percent of all broiler compliance costs are passed on to the food processing sectors. Based on the results of this analysis, EPA estimates that the range of potential annual costs to hog processors is $135 million (partial cost passthrough) to $306 million (full cost passthrough). EPA estimates that the range of potential annual costs to broiler processors as $34 million (partial cost passthrough) to $117 million (full cost passthrough). These results are shown in Table 10–9 and are expressed in 1999 pre-tax dollars.

To assess the magnitude of impacts that could accrue to processors using this approach, EPA compares the passed through compliance costs to both aggregate processor costs of production and to revenues (a sales test). The results of this analysis are shown in Table 10–9 and are presented in terms of the equivalent 1997 compliance cost as compared to 1997 data from the Department of Commerce on the revenue and costs among processors in the hog and broiler industries. As shown, EPA estimates that, even under full cost passthrough, incremental cost changes are less than two percent and passed through compliance costs as a share of revenue are estimated at less than one percent. EPA solicits comment on this approach. Additional information is provided in the Economic Analysis.

TABLE 10–9.—IMPACT OF PASSED THROUGH COMPLIANCE COSTS UNDER CO-PROPOSED ALTERNATIVES

Sector	Passed through compliance cost		1997 revenues	1997 delivered cost	1997 Passed through cost-to-revenues		Passed through cost-to-delivered cost	
	Partial CPT	100% CPT			Partial CPT	100% CPT	Partial CPT	100% CPT
	($1999, million)		($1997, million)		(percent, comparing costs in $1997)			
Hog Processors								
Two-Tier	135	294	38,500	15,700	0.3%	0.7%	0.8%	1.8%
Three-Tier	141	306			0.4%	0.8%	0.9%	1.9%
Broiler Meat Processors								
Two-Tier	34	97	17,700	9,100	0.2%	0.5%	0.4%	1.0%
Three-Tier	41	117			0.2%	0.6%	0.4%	1.2%

Source: USEPA. 1997 processor revenues and costs are from the Department of Commerce. Option/Scenario definitions provided in Table 10–2. Estimated compliance costs are pre-tax. CPT = Cost passthrough. Partial CPT assumes 46% CPT for the hog sector and 35% CPT for the broiler sector.

3. Market Level Analysis

As discussed in Section X.D.3, EPA's market analysis evaluates the effects of the proposed regulations on commodity prices and quantities at the national level. EPA's market model predicts that the proposed regulations will not result in significant industry-level changes in production and prices for most sectors. Tables 10–10 and 10–11 show predicted farm and retail price changes across the two-tier (500 AU threshold) and three-tier structures. For comparison purposes, the average annual percentage change in price from 1990 to 1998 is shown. Analyses of other technology options and scenarios considered by EPA are provided in the record.

EPA expects that predicted changes in animal production may raise producer prices, as the market adjusts to the proposed regulatory requirements. For most sectors, EPA estimates that producer price changes will rise by less than one percent of the pre-regulation baseline price (Table 10–10). The exception is in the hog sector, where estimated compliance costs slightly exceed one percent of the baseline price. At the retail level, EPA expects that the proposed regulations will not have a substantial impact on overall production or consumer prices for value-added meat, eggs, and fluid milk and dairy products. EPA estimates that retail price increases resulting from the proposed regulations will be under one percent of baseline prices in all sectors, averaging below the rate of general price inflation for all foods (Table 10–11). In terms of retail level price changes, EPA estimates that poultry and red meat prices will rise about one cent per pound. EPA also estimates that egg prices will rise by about one cent per dozen and that milk prices will rise by about one cent per gallon.

Appendix D of the Economic Analysis provides results of sensitivity analyses, conducted by EPA, to examine the impact under differing model assumptions. EPA examined variations in the price elasticities and prices assumed for these industries, based on information reported in the agricultural literature and statistical compendiums. These sensitivity analyses demonstrate that the results presented here are stable across a range of possible modeling assumptions.

TABLE 10–10.—ESTIMATED INCREASES IN FARM PRICES UNDER THE CO-PROPOSED ALTERNATIVES

Option/Scenario	Beef ($/cwt)	Dairy ($/cwt)	Hogs ($/cwt)	Broilers (cents/lb)	Layers (cents/doz.)	Turkeys (cents/lb)
Pre-reg. Avg Price	$68.65	$13.90	$56.41	38.43	72.51	41.66
Avg. Chg 90–98	4.6%	8.0%	15.2%	5.7%	11.5%	4.4%
Two-Tier	0.22	0.06	0.61	0.19	0.14	0.13
Three-Tier	0.24	0.08	0.66	0.23	0.15	0.16

Source: USEPA, except historical data that are from USDA. Option/Scenario definitions provided in Table 10–2.

TABLE 10–11.—ESTIMATED INCREASES IN RETAIL PRICES UNDER THE CO-PROPOSED ALTERNATIVES

Option/Scenario	Beef ($/lb)	Dairy (Index)	Hogs ($/lb)	Broilers (cents/lb)	Layers (cents/doz.)	Turkeys (cents/lb)
Pre-reg. Avg Price	$2.91	145.50	$2.55	156.86	110.11	109.18
Avg. Chg 90–98 (%)	2.3%	2.4%	5.1%	3.0%	7.2%	2.4%
Two-Tier	0.00	0.61	0.01	0.19	0.14	0.13
Three-Tier	0.00	0.78	0.01	0.23	0.15	0.16

Source: USEPA, except historical data that are from USDA. Option/Scenario definitions provided in Table 10–2.

EPA does not expect that the proposed regulations will result in significant changes in aggregate employment or national economic output, measured in terms of Gross Domestic Product (GDP). EPA expects, however, that there will be losses in employment and economic output associated with decreases in animal production due to rising compliance costs. These losses are estimated throughout the entire economy, using

available modeling approaches, and are not attributable to the regulated community only. This analysis also does not adjust for offsetting increases in other parts of the economy and other sector employment that may be stimulated as a result of the proposed regulations, such as the construction and farm services sectors.

Table 10–12 show these predicted changes. Employment losses are measured in full-time equivalents (FTEs) per year, including both direct and indirect employment. Under the two-tier structure (500 AU threshold), EPA estimates that the reduction in aggregate national level of employment is 16,600 FTEs. Under the three-tier structure, EPA estimates total aggregate job losses at 18,900 FTEs. This projected change is modest when compared to total national employment, estimated at about 129.6 million jobs in 1997. EPA's estimate of the aggregate reductions in national economic output is $1.7 billion under the two-tier structure. Under the three-tier structure, EPA estimates the loss to GDP at $1.9 billion. This projected change is also modest when compared to total GDP, estimated at $8.3 trillion in 1997. Additional information is available in the Economic Analysis.

TABLE 10–12.—ESTIMATED DECREASES IN EMPLOYMENT AND ECONOMIC OUTPUT

Option/ Scenario	Beef	Dairy	Hogs	Poultry	Total
Estimated Decreases in Employment (Number of FTEs)					
Two-Tier	4,600	3,200	6,400	2,400	16,600
Three-Tier	4,900	4,100	6,900	3,000	18,900
Estimated Decreases in Economic Output ($GDP)					
Two-Tier	$476	$307	$681	$251	$1,715
Three-Tier	$510	$396	$734	$306	$1,946

Source: USEPA. Option/Scenario definitions provided in Table 10–2. FTE = Full-time equivalent.

G. Additional Impacts

1. Costs to the NPDES Permitting Authority

Additional costs will be incurred by the NPDES permitting authority to alter existing state programs and obtain EPA approval to develop new permits, review new permit applications and issue revised permits that meet the proposed regulatory requirements. Under the proposed rule, NPDES permitting authorities will incur administration costs related to the development, issuance, and tracking of general or individual permits.

State and federal administrative costs to issue a general permit include costs for permit development, public notice and response to comments, and public hearings. States and EPA may also incur costs each time a facility operator applies for coverage under a general permit due to the expenses associated with a Notice of Intent (NOI). These per-facility administrative costs include initial facility inspections and annual record keeping expenses associated with tracking NOIs. Administrative costs for an individual permit include application review by a permit writer, public notice, and response to comments. An initial facility inspection may also be necessary. EPA developed its unit permit costs assumed for this analysis based on information obtained from a state permitting personnel. The cost assumptions used to estimate develop, review, and approve permits and inspect facilities are presented in the Development Document.

EPA assumes that, under the two-tier structure, an estimated 25,590 CAFOs would be permitted. This estimate consists of 24,760 State permits (17,340 General and 7,420 Individual permits) and 1,030 Federal permits (720 General and 310 Individual permits). Under the three-tier structure, an estimated 31,930 CAFOs would be permitted, consisting of 30,650 State permits (21,460 General and 9,190 Individual permits) and 1,280 Federal permits (900 General and 380 Individual permits). Information on the estimated number of permits required under other regulatory alternatives is provided in the Economic Analysis. The basis for these estimates is described in the Development Document that supports this rulemaking.

As shown in Table 10–13, under the two-tier structure, EPA estimates State and Federal administrative costs to implement the permit program to be $6.2 million per year: $5.9 million for states and $350,000 for EPA. Under the three-tier structure, EPA estimates State and Federal administrative costs to implement the permit program to be $7.7 million per year: $7.3 million for states and $416,000 for EPA. EPA expects that the bulk (95 percent) of estimated administrative costs will be incurred by the state permitting authority. EPA has expressed these costs in 1999 dollars, annualized over the 5-year permit life using a seven percent discount rate. The range of costs across each of the regulatory options is $4.2 million to $9.1 million annually (alternatives Scenario 1 and Scenario 4b, respectively). See Table 10–13. (EPA did not estimate permit authority costs under alternative NPDES Scenarios 5 and 6, described in Table 10–2.) This analysis is available in the record and is summarized in Section 10 of the Economic Analysis.

This analysis was conducted to evaluate the costs of the proposed rule to governments, as required under the Unfunded Mandates Reform Act (UMRA), as discussed in Section XIII.C of this preamble.

TABLE 10–13.—ANNUAL STATE AND FEDERAL ADMINISTRATIVE COSTS, $1999

Regulatory scenario	State	Federal	Total
Scenario 1	3,922,990	268,630	4,191,620
Scenario 2	7,233,470	413,060	7,646,530
Scenario 3 (''Three-tier'')	7,279,560	415,600	7,695,160
Scenario 4a (''Two-tier'')	5,910,750	351,090	6,224,040

TABLE 10–13.—ANNUAL STATE AND FEDERAL ADMINISTRATIVE COSTS, $1999—Continued

Regulatory scenario	State	Federal	Total
Scenario 4b	8,645,520	483,010	9,128,530

Source: USEPA. See Economic Analysis. Other supporting documentation is in the Development Document.

2. Community Impacts

As discussed in Section X.F.3, EPA does not expect that the proposed regulations will result in significant increases in retail food prices or reductions in national level employment.

EPA also considered other community level impacts associated with this rulemaking. In particular, EPA considered whether the proposed rule could have community level and/or regional impacts if it substantially altered the competitive position of livestock and poultry production across the nation, or led to growth or reductions in farm production (in- or out-migration) in different regions and communities. Ongoing structural and technological change in these industries has influenced where farmers operate and has contributed to locational shifts between the more traditional production regions and the more emergent, nontraditional regions. Production is growing rapidly in these regions due to competitive pressures from more specialized producers who face lower per-unit costs of production. This is especially true in hog and dairy production.

To evaluate the potential for differential impacts among farm production regions, EPA examined employment impacts by region. EPA concluded from this analysis that more traditional agricultural regions would not be disproportionately affected by the proposed regulations. This analysis is provided in the Economic Analysis.

EPA does not expect that today's proposed requirements will have a significant impact on where animals are raised. On one hand, on-site improvements in waste management and disposal, as required by the proposed regulations, could accelerate recent shifts in production to more nontraditional regions as higher cost producers in some regions exit the market to avoid relatively higher retrofitting associated with bringing existing facilities into compliance. On the other hand, the proposed regulations may favor more traditional production systems where operators grow both livestock and crops, since these operations tend to have available cropland for land application of manure nutrients. These types of operations tend to be more diverse and not as specialized and, generally, tend to be smaller in size. Long-standing farm services and input supply industries in these areas could likewise benefit from the proposed rule, given the need to support on-site improvements in manure management and disposal. Local and regional governments, as well as other non-agricultural enterprises, would also benefit.

3. Foreign Trade Impacts

Foreign trade impacts are difficult to predict, since agricultural exports are determined by economic conditions in foreign markets and changes in the international exchange rate for the U.S. dollar. However, EPA predicts that foreign trade impacts as a result of the proposed regulations will be minor given the relatively small projected changes in overall supply and demand for these products and the slight increase in market prices, as described in Section X.F.3.

Despite its position as one of the largest agricultural producers in the world, historically the U.S. has not been a major player in world markets for red meat (beef and pork) or dairy products. In fact, until recently, the U.S. was a net importer of these products. The presence of a large domestic market for value-added meat and dairy products has limited U.S. reliance on developing export markets for its products. As the U.S. has taken steps to expand export markets for red meat and dairy products, one major obstacle has been that it remains a relatively high cost producer of these products compared to other net exporters, such as New Zealand, Australia, and Latin America, as well as other more established and government-subsidized exporting countries, including the European Union and Canada. Increasingly, however, continued efficiency gains and low-cost feed is making the U.S. more competitive in world markets for these products, particularly for red meat. While today's proposed regulations may raise production costs and potentially reduce production quantities that would otherwise be available for export, EPA believes that any quantity and price changes resulting from the proposed requirements will not significantly alter the competitiveness of U.S. export markets for red meat or dairy foods.

In contrast, U.S. poultry products account for a controlling share of world trade and exports account for a sizable and growing share of annual U.S. production. Given the established presence of the U.S. in world poultry markets and the relative strength in export demand for these products, EPA does not expect that the predicted quantity and price changes resulting from today's proposed regulations will have a significant impact on the competitiveness of U.S. poultry exports.

As part of its market analysis, EPA evaluated the potential for changes in traded volumes, such as increases in imports and decreases in exports, and concluded that volume trade will not be significantly impacts by today's proposed regulations. EPA estimates that imports (exports) will increase (decrease) by less than 1 percent compared to baseline (pre-regulation) levels in each of the commodity sectors. By sector, the potential change in imports compared to baseline trade levels ranges from a 0.02 percent increase in broiler imports to a 0.34 percent increase in dairy product imports. The predicted drop in U.S. exports ranges from a 0.01 percent reduction in turkey exports to a 0.25 percent reduction in hog exports.

H. Cost-Effectiveness Analysis

As part of the process of developing effluent limitations guidelines and standards, EPA typically conducts a cost-effectiveness analysis to compare the efficiencies of regulatory options for removing pollutants and to compare the proposed BAT option to other regulatory alternatives that were considered by EPA. For the purpose of this regulatory analysis, EPA defines cost-effectiveness as the incremental annualized cost of a technology option per incremental pound of pollutant removed annually by that option. The analyses presented in this section include a standard cost-effectiveness (C–E) analysis for toxic pollutants, but also expand upon EPA's more traditional approach to include an analysis of the cost-effectiveness of removing nutrients and sediments. This expanded approach is more appropriate for evaluating the broad range of pollutants in animal manure and wastewater.

The American Society of Agricultural Engineers (ASAE) reports that the constituents present in livestock and poultry manure include: boron, cadmium, calcium, chlorine, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, sodium, sulfur, zinc, nitrogen and phosphorus species, total suspended solids, and pathogens. Of these pollutants, EPA's standard C–E analysis is suitable to analyze only the removal of metals and metallic compounds. EPA's standard C–E analysis does not adequately address removals of nutrients, total suspended solids, and pathogens. To account for the estimated removals of nutrients and sediments under the proposed regulations in the analysis, the Agency has developed an alternative approach to evaluate the pollutant removal effectiveness relative to cost. At this time, EPA has not developed an approach that would allow a similar assessment of pathogen removals. Section 10 of the Economic Analysis describes the methodology, data, and results of this analysis. (EPA did not estimate cost-effectiveness for the alternative NPDES Scenarios 5 and 6, described in Table 10–2.)

For this analysis, EPA has estimated the expected reduction of select pollutants for each of the regulatory options considered. These estimates measure the amount of nutrients, sediments, metals and metallic compounds that originate from animal production areas that would be removed under a post-regulation scenario (as compared to a baseline scenario) and not reach U.S. waters. Additional information on EPA's estimated loadings and removals under post-compliance conditions is provided in the Development Document and the Benefits Analysis that support today's rulemaking.

1. Cost-Effectiveness: Priority Pollutants

For this rulemaking, EPA identified a subset of metallic compounds for use in the C–E

For this rulemaking, EPA identified a subset of metallic compounds for use in the C–E analysis: zinc, copper cadmium, nickel, arsenic, and lead. These six compounds are a subset of all the toxic compounds reported to be present in farm animal manure (varies by animal species). Therefore, if loading reductions of all priority pollutants in manure were evaluated, the proposed regulations would likely be even more cost-effective (i.e., lower cost per pound-equivalent removal).

EPA calculates cost-effectiveness as the incremental annual cost of a pollution control option per incremental pollutant removal. In C–E analyses, EPA measures pollutant removals in toxicity normalized units called ''pounds-equivalent,'' where the pounds-equivalent removed for a particular pollutant is determined by multiplying the number of pounds of a pollutant removed by each option by a toxicity weighting factor. The toxic weighting factors account for the differences in toxicity among pollutants and are derived using ambient water quality criteria. The cost-effectiveness value, therefore, represents the unit cost of removing an additional pound-equivalent of pollutants. EPA calculates the cost-effectiveness of a regulatory option as the ratio of pre-tax annualized costs of an option to the annual pounds-equivalent removed by that option, expressed as the average or incremental cost-effectiveness for that option. EPA typically presents C–E results in 1981 dollars for comparison purposes with other regulations. EPA uses these estimated compliance costs to calculate the cost-effectiveness of the proposed regulations, which include total estimated costs to CAFOs and offsite recipients of CAFO manure (Section X.E) and costs to the permitting authority (Section X.G.1). Additional detail on this approach is provided in Appendix E of the Economic Analysis.

Cost-effectiveness results for select regulatory alternatives are presented in Table 10–14. Results shown in Table 10–14 include the BAT Option (Option 3 for beef and dairy subcategories and Option 5 for the swine and poultry subcategories) and Option 3+5 (both Option 3 and 5 for all subcategories). Options are shown for four CAFO coverage scenarios, including CAFOs with more than 1,000 AU and CAFOs with more than 500 AU (two-tier structure), and operations with more than 300 AU, both under Scenario 4b and as defined under Scenario 3 (three-tier structure). The differences in CAFO coverage provide an upper and lower bound of the analysis to roughly depict the alternative NPDES scenarios. Both incremental and average C–E values are shown.

Incremental cost-effectiveness is the appropriate measure for comparing one regulatory alternative to another for the same subcategory. In general, the lower the incremental C–E value, the more cost-efficient the regulatory option is in removing pollutants, taking into account their toxicity. For this rulemaking, EPA compares the cost-effectiveness across alternative NPDES Scenarios to assess the Agency's decision to define as CAFO operations with more than 500 AU (two-tier structure) and, alternatively, some operations with more than 300 AU (two-tier structure).

As shown in Table 10–14, the BAT Option is the most cost-efficient under each of the co-proposed alternatives. Under both the two-tier (500 AU) and three-tier structures, EPA estimates an incremental cost-effectiveness value of about $30 per pounds-equivalent (lbs.-eq.) removed. This compares to the alternative Scenario 4b that have a higher estimated incremental cost-effectiveness ($76/lbs.-eq., if all CAFOs with more than 1,000 AU are regulated). (Since the change in removals between Scenario 3 and Scenario 4b is zero, the incremental C–E value is ''undefined.'') The BAT Option is also more efficient than requiring Option 3+5 for all subcategories, which has higher costs but results in no additional pollutant removals compared to the BAT Option. This is because the ELG options differ mostly in terms of their monitoring and sampling requirements but establish no additional pollutant controls. (Since the change in removals between the BAT Option and Option 3+5 is zero, the incremental C–E value is undefined.)

The average cost-effectiveness reflects the ''increment'' between no regulation and regulatory options shown. For the BAT Option, EPA estimates an average value at $55 per lbs.-eq. to $58 per lbs.-eq., depending on the proposed tier structure (Table 10–14). These estimated average values are low compared to the alternative NPDES scenarios since the average cost-effectiveness value is higher ($76/lbs.-eq., if all CAFOs with more than 1,000 AU are regulated; $62/lbs.-eq. for all CAFOs with more than 300 AU). This average cost is also low compared to previous ELG rulemakings, where estimated costs have, in some cases, exceeded $100/lbs.-eq. removed. This information is provided in the Economic Analysis. In addition, as shown in Table 10–14, average cost-effectiveness is nearly twice as high under the more stringent Option 3+5 for all subcategories (estimated at more than $100 per lbs.-eq. removed). Costs, but also removals, are lower under the less stringent Option 1 (also referred to as the ''nitrogen-based'' option) compared to other technology options. As described in Section VIII, EPA determined that this option would not represent the best available technology and so chose not to propose it. This analysis, along with additional results for each subcategory and other regulatory alternatives, is provided in Appendix E on the Economic Analysis.

TABLE 10–14.—COST-EFFECTIVENESS RESULTS BY SELECT OPTION/SCENARIO ($1981)

Option	Total annual		Average cost-effectiveness	Incremental cost-effectiveness
	Pound-equivalents removed [1]	Total cost [2]		
	(million pounds)	($ millions)	($/lbs.-eq.)	
''BAT Option'' ELG Option 3 (Beef/Dairy) and 5 (Swine/Poultry)				
>1000 AU	5.3	402	76	76
>500 AU ''Two-tier''	8.4	491	58	29
Scenario 3 ''Three-tier''	9.4	518	55	28
>300 AU	9.4	579	62	ND
ELG Option 3+5 (All Subcategories)				
>1000 AU	5.3	1,047	197	197
>500 AU ''Two-tier''	8.4	1,212	144	53
Scenario 3 ''Three-tier''	9.4	1,251	133	40
>300 AU	9.4	1,353	144	ND

Source: USEPA. See Economic Analysis. Option/Scenario definitions provided in Table 10–2. ND=Not Determined.
[1] Pound-equivalent removals are calculated from removals estimated by EPA's loadings analysis, described in the Benefits Analysis and the Development Document, adjusting for each pollutants toxic weighting factor (as described in the Economic Analysis).
[1] Costs are pre-tax and indexed to 1981 dollars using the Construction Cost Index.

2. Cost-Effectiveness: Nutrients and Sediments

In addition to conducting a standard C–E analysis for select toxic pollutants (Section X.H.1), EPA also evaluated the cost-effectiveness of removing select non-conventional and conventional pollutants, including nitrogen, phosphorus, and sediments. For this analysis, sediments are used as a proxy for total suspended solids (TSS). This analysis does not follow the methodological approach of a standard C–E analysis. Instead, this analysis compares the estimated compliance cost per pound of pollutant removed to a recognized benchmark, such as EPA's benchmark for conventional pollutants or other criteria for existing treatment, as reported in available cost-effectiveness studies.

The research in this area has mostly been conducted at municipal facilities, including publicly owned treatment works (POTWs) and wastewater treatment plants (WWTPs). Additional information is available based on the effectiveness of various nonpoint source controls and BMPs (Best Management Practices) and other pollutant control technologies that are commonly used to control runoff from agricultural lands. A summary of this literature is provided in the Economic Analysis. Benchmark estimates are used to evaluate the efficiency of regulatory options in removing a range of pollutants and to compare the results for each of the co-proposed tier structures to other regulatory alternatives. This approach also allows for an assessment of the types of management practices that will be implemented to comply with the proposed regulations.

Cost-effectiveness results for select regulatory alternatives are presented in Table 10–15. Results shown in Table 10–15 include the BAT Option (Option 3 for beef and dairy subcategories and Option 5 for the swine and poultry subcategories) and Option 3+5 (both Option 3 and 5 for all subcategories). Options are shown for four CAFO coverage scenarios, including CAFOs with more than 1,000 AU and CAFOs with more than 500 AU (two-tier structure), and operations with more than 300 AU, both under Scenario 4b and as defined under Scenario 3 (three-tier structure). The differences in CAFO coverage provide an upper and lower bound of the analysis to roughly depict the alternative NPDES scenarios.

The values in Table 10–15 are average cost-effectiveness values that reflect the increment between no regulation and the considered regulatory options. All costs are expressed in pre-tax 1999 dollars. Estimated compliance costs used to calculate the cost-effectiveness of the proposed regulations include total estimated costs to CAFOs and offsite recipients of CAFO manure (Section X.E) and costs to the permitting authority (Section X.G.1).

Under the co-proposed tier structures, EPA estimates an average cost-effectiveness of nutrient removal at $4.60 per pound (two-tier) to $4.30 per pound (three-tier) of nitrogen removed. For phosphorus removal, removal costs are estimated at $2.10 to $2.20 per pound of phosphorus removed (Table 10–15). For nitrogen, EPA uses a cost-effectiveness benchmark established by EPA's Chesapeake Bay Program to assess the costs to WWTPs to implement BNR (biological nutrient removal) retrofits. EPA's average benchmark estimate is about $4 per pound of nitrogen removed at WWTPs in four states (MD, VA, PA, and NY), based on a range of costs of $0.80 to $5.90 per pound of nitrogen removed. Using this benchmark, EPA's estimated cost-effectiveness to remove nitrogen under the proposed regulations exceed EPA's average benchmark value, but falls within the estimated range of removal costs. However, EPA's estimated cost-effectiveness to remove phosphorus is lower than benchmark used for phosphorus of roughly $10 per pound, reported in the agricultural research as the costs to remove phosphorus using various nonpoint source controls and management practices. Available data on phosphorus removal costs for industrial point source dischargers are much higher (exceed $100 per pound of phosphorus removed). Based on these results, EPA concludes that these values are cost-effective.

Costs and removals are nearly twice as high under the more stringent Option 3+5 for all subcategories (Table 10–15). Costs and removals are lower under the less stringent Option 1, but EPA chose not to propose Option 1 because it does not represent the best available technology (also described in Section VIII of the preamble).

EPA estimates that the co-proposed thresholds (two-tier and three-tier structures) are more cost-effective compared to alternative AU thresholds, given slightly lower average cost-effectiveness values (Table 10–15). EPA

estimates that the average cost-effectiveness to remove nitrogen is $5.10 per pound of nitrogen removed at a threshold that would regulate as CAFOs all operations with more than 1,000 AU; the average cost-effectiveness is $4.80 per pound of nitrogen removed at the alternative 300 AU threshold (Table 10–15). EPA estimates that the average cost-effectiveness to remove phosphorus is $2.50 per pound and $2.30 per pound of phosphorus removed at the 1,000 AU and 300 AU threshold. EPA also estimates that the co-proposed tier structures are also the most cost-efficient, compared to other alternatives considered by EPA. These results, based on incremental cost-effectiveness values, are provided in the Economic Analysis.

Table 10–15 also shows that the cost to remove sediments under the BAT Option/Scenario is estimated at $0.003 per pound of sediment removal (1999 dollars). This estimated per-pound removal cost is low compared to EPA's POTW benchmark for conventional pollutants. This benchmark measures the potential costs per pound of TSS and BOD (biological nutrient demand) removed for an ''average'' POTW (see 51 FR 24982). Indexed to 1999 dollars, EPA's benchmark costs are about $0.70 per pound of TSS and BOD removed. The average cost-effectiveness of sediment removal under the BAT Option/Scenario is lower than under the alternative options. Option 1 results across the range of NPDES Scenarios are estimated at about $0.05 per-pound removal of sediments. This analysis, along with additional results for each subcategory and other regulatory alternatives, is provided in Appendix E on the Economic Analysis.

TABLE 10–5.—COST-EFFECTIVENESS RESULTS BY SELECT OPTION/SCENARIO ($1999)

Option/Scenario	Total cost [1]	Sediments	Nitrogen	Phosphorus	Sediments	Nitrogen	Phosphorus
	($m 1999)	(million pounds of removals)			(average $ per pound removed		
''BAT Option'' ELG Option 3 (Beef/Dairy) and 5 (Swine/Poultry)							
>1000 AU	$688	209050	136	280	$0.003	$5.1	$2.5
>500 AU ''Two-tier''	840	299708	182	377	0.003	4.6	2.2
>300 AU ''Three-tier''	887	335456	206	425	0.003	4.3	2.1
>300 AU	991	335456	206	425	0.003	4.8	2.3
ELG Option 3+5 (All subcategories							
>1000 AU	1,791	209050	136	280	0.009	13.2	6.4
>500 AU ''Two-tier''	2,074	299708	182	377	0.007	11.4	5.5
>300 AU ''Three-tier''	2,141	335456	206	425	0.006	10.4	5.0
>300 AU	2,316	335456	206	425	0.007	11.2	5.5

Source: USEPA. See Economic Analysis. Option/Scenario definitions provided in Table 10–2. ND=Not Determined.
[1] Costs are pre-tax.

I. Cost-Benefit Analysis

EPA estimated and compared the costs and benefits attributed to the proposed regulations. The cost and benefit categories that the Agency was able to quantify and monetize for the proposed regulations are shown in Table 10–16.

Total social costs of the proposed regulations range from $847 million to $949 million annually, depending on the co-proposed approach (Table 10–16). These costs include compliance costs to industry, costs to recipients of CAFO manure, and administrative costs to States and Federal governments.

Under the two-tier structure, EPA projects that total compliance cost to industry is $831 million per year (pre-tax)/$572 million (post-tax). By comparison, under the three-tier structure, EPA estimates that the cost to industry is $930 million per year (pre-tax)/$658 million (post-tax). Costs to industry include annualized capital costs, operating and maintenance costs, start-up and recurring costs, and also recordkeeping costs. Estimated costs cover four broad categories: nutrient management planning, facility upgrades, land application, and technologies for balancing on-farm nutrients. In addition, under the two-tier structure, EPA estimates that the cost to off-site recipients of CAFO manure is $10 million per year. The administrative cost to State and Federal governments to implement the permit program is $6 million per year. Under the three-tier structure, the annual cost to off-site recipients of manure is $11 million and State and Federal administrative costs are $8 million per year.

EPA estimates that the monetized benefits of the proposed regulations range from $146 million to $182 million annually, depending on the co-proposed approach (Table 10–16). Annual benefits are estimated to range from $146 million to $165 million under the two-tier structure; under the three-tier structure, estimated benefits range from $163 million to $182 million annually. EPA was only able to monetize (*i.e.,* place a dollar value on) a small subset of the range of potential benefits that may accrue under the proposed regulations. Data and methodological limitations restricted the number of benefits categories that EPA was able to reasonably quantify and monetize. The proposed regulations benefits are primarily in the areas of reduced health risks and improved water quality, as shown in Table 10–16. In addition to these monetized benefits, EPA expects that additional benefits will accrue under the regulations, including reduced drinking water treatment costs, reduced odor and air emissions, improved water quality in estuaries, and avoided loss in property value near CAFOs, among other benefits. These benefits are described in more detail in the Benefits Analysis and other supporting documentation provided in the record.

TABLE 10–16.—TOTAL ANNUAL SOCIAL COSTS AND MONETIZED BENEFITS, $1999

[In millions of dollars]

Total social costs	''Two-Tier'' structure (500 AU threshold)	Three-Tier structure (Scenario 3)
Industry Compliance Costs (pre-tax)	830.7	930.4
NPDES Permitting Costs	6.2	7.7
Offsite Recipients of CAFO Manure	9.6	11.3
Total Social Costs	846.5	949.4
Monetized Benefits		
Improved surface water quality	108.5	127.1
Reduced shellfish bed closures	0.2–2.4	0.2–2.7
Reduced fish kills	0.2–0.4	0.2–0.4
Improved water quality in private wells	36.6–53.9	35.4–52.1
Total Monetized Benefits	145.5–165.1	163.0–182.3

J. Initial Regulatory Flexibility Analysis

Pursuant to Section 603 of the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), the Agency prepared an Initial Regulatory Flexibility Analysis (IRFA) to assess the impacts on small livestock and poultry feeding operations. EPA's IRFA and other supplemental economic analyses, as required under Section 607 of the RFA, are provided in Section 9 of the Economic Analysis. This section summarizes the estimated number of small entities to which the rule will apply and quantitatively describes the effects of the proposed regulations. Other information on EPA's approach for estimating the number of small businesses in these sectors is provided in the Final Report of the Small Business Advocacy Review Panel on EPA's Planned Proposed Rule on National Pollutant Discharge Elimination System (NPDES) and Effluent Limitations Guideline (ELG) Regulations for Concentrated Animal Feeding Operations (referred to as the ''Panel Report''). The Panel Report is available in the rulemaking record, as well as online at http://www.epa.gov/sbrefa. A summary of the Small Business Advocacy Review (SBAR) Panel proceedings and recommendations is provided in Section XII.G of this preamble. Section XIII.B of this preamble summarizes other requirements to comply with the RFA.

1. Definition of Small Business

The Small Business Administration (SBA) defines a ''small business'' in the livestock and poultry sectors in terms of average annual receipts (or gross revenue). SBA size standards for these industries define a ''small business'' as one with average annual revenues over a 3-year period of less than $0.5 million annually for dairy, hog, broiler, and turkey operations; $1.5 million for beef feedlots; and $9.0 million for egg operations. In today's rule, EPA is proposing to define a ''small'' egg laying operation for purposes of its regulatory flexibility assessments as an operation that generates less than $1.5 million in annual revenue. Because this definition of small business is not the definition established under the Regulatory Flexibility Act (RFA), EPA is specifically seeking comment on the use of this alternative definition as part of today's notice of the proposed rulemaking (see Section XIII.B and Section XIV). EPA also has consulted with the SBA Chief Counsel for Advocacy on the use of this alternative definition. EPA believes this definition better reflects the agricultural community's sense of what constitutes a small business and more closely aligns with the small business definitions codified by SBA for other animal operations. A summary of EPA's rationale and supporting analyses pertaining to this alternative definition is provided in the record and in the *Economic Analysis.*

2. Number of Small Businesses Affected under the Proposed Regulations

Table 10–17 shows EPA's estimates of the number of small businesses in the livestock and poultry sectors and the number of small businesses that are expected to be affected by the proposed regulations. The approach used to derive these estimates is described in more detail in Section 9 of the Economic Analysis and also in Sections 4 and 5 of the Panel Report. EPA presented this and other alternative approaches during the SBAR Panel proceedings, as discussed in Section XII.G.2.a of this document. EPA is requesting public comment on this approach.

EPA uses three steps to determine the number of small businesses that may be affected by the proposed regulations. First, EPA identifies small businesses in these sectors by equating SBA's annual revenue definition with the number of animals at an operation. Second, EPA estimates the total number of small businesses in these sectors using farm size distribution data from USDA. Third, based on the regulatory thresholds being proposed, EPA estimates the number of small businesses that would be subject to the proposed requirements. These steps are summarized below.

In the absence of farm or firm level revenue data, EPA identifies small businesses in these sectors by equating SBA's annual revenue definitions of ''small business'' to the number of animals at these operations (step 1). This step produces a threshold based on the number of animals that EPA uses to define small livestock and poultry operations and reflects the average farm inventory (number of animals) that would be expected at an operation with annual revenues that define a small business. This initial conversion is necessary because USDA collects data by farm size, not by business revenue. With the exception of egg laying operations, EPA uses SBA's small business definition to equate the revenue threshold with the number of animals raised on-site at an equivalent small business in each sector. For egg laying operations, EPA uses its alternative revenue definition of small business.

EPA estimates the number of animals at an operation to match SBA's

definitions using SBA's annual revenue size standard (expressed as annual revenue per entity) and USDA-reported farm revenue data that are scaled on a per-animal basis (expressed as annual revenue per inventory animal for an average facility). Financial data used for this calculation are from USDA's 1997 ARMS database. This approach and the data used for this calculation are outlined in Section 9 of the Economic Analysis. The resultant size threshold represents an average animal inventory for a small business. For the purpose of conducting its IRFA for this rulemaking, EPA is evaluating ''small business'' for these sectors as an operation that houses or confines less than: 1,400 fed beef cattle; 200 mature dairy cattle; 1,400 market hogs; 25,000 turkeys; 61,000 layers; or 260,000 broilers (Table 10–17).

EPA then estimates the total number of small businesses in these sectors using facility size distribution data from USDA (step 2). Using the threshold sizes identified for small businesses, identified above, EPA matches these thresholds with the number of operations associated with those size thresholds to estimate the total number of small animal confinement operations in these sectors. Finally, based on the regulatory thresholds being proposed—e.g., operations with more than 500 AU are CAFOs—EPA estimates the number of small businesses that will be subject to the proposed requirements (step 3). The 1997 Census constitutes the primary data source that EPA uses to match the small business thresholds (e.g., a small dairy operation has less than 200 milk cows) to the number of facilities that match that size group (e.g., the number of dairies with less than 200 cows, as reported by USDA). EPA also used other supplemental data, including other published USDA data and information from industry and the state extension agencies.

TABLE 10–17.—NUMBER OF SMALL CAFOS THAT MAY BE AFFECTED BY THE PROPOSED REGULATIONS

Sector	Total annual ($million) revenue [1] (a)	Revenue per head [2] (b)	No. of animals (Avg. U.S.) (c=a/b)	Estimated number of small AFOs	Two-Tier ''Small'' CAFOs	Three-Tier ''Small'' CAFOs
Cattle [3]	1.5	1,060	1,400	106,450	2,280	2,600
Dairy	0.5	2,573	200	109,740	50	50
Hogs	0.5	363	1,400	107,880	300	300
Broilers	0.5	2	260,000	34,530	9,470	13,410
Egg Layers	9.0	25	365,000	ND	ND	ND
	1.5		61,000	73,710	200	590
Turkeys	0.5	20	25,000	12,320	0	500
All AFOs [4]	NA	NA	NA	355,650	10,550	14,630

NA=Not Applicable. ND = Not Determined. ''AFOs'' have confined animals on-site. ''CAFOs'' are assumed to have more than 500 AU.

[1] SBA Size Standards by SIC industry (13 CFR Part 121). EPA assumes an alternative definition of $1.5 million in annual revenues for egg layers.

[2] Average revenue per head across all operations for each sector derived from data obtained from USDA's 1997 ARMS data.

[3] Includes fed cattle, veal and heifers.

[4] Total adjusts for operations with mixed animal types and includes designated CAFOs (expressed over a 10-year period). See Section VI.1 of this document for estimates of the total number of AFOs (including operations that are not defined as small businesses by SBA).

EPA estimates that there were approximately 376,000 animal confinement facilities in 1997 (Table 6–1). Most of these (95 percent) are small businesses, as defined by this approach (Table 10–17). However, not all of these operations will be affected by the proposed regulations.

For this analysis, EPA has identified the number of CAFOs that are also small businesses that would be subject to today's proposal. Under the two-tier structure, EPA estimates that 10,550 operations that will be subject to the proposed requirements that are small businesses. Under the three-tier structure, an estimated 14,630 affected operations are small businesses. See Table 10–17. The difference in the number of affected small businesses is among poultry producers, particularly broiler operations.

Under the two-tier structure, EPA estimates that there are 10,050 operations with more than 500 AU that may be defined as CAFOs that also meet the ''small business'' definition. Under the three-tier structure, there are 14,530 operations with more than 300 AU that may be defined as CAFOs that are small businesses that meet the proposed risk-based conditions (described in Section VII). These totals adjusts for the number of operations with more than a single animal type. Under both co-proposed alternatives, most operations are in the broiler and cattle sectors. By broad facility size group, an estimated 4,060 operations have more than 1,000 AU, most of which are broiler operations (about 77 percent) and cattle operations (18 percent), including fed cattle, veal, and heifer operations. An estimated 6,490 operations have between 500 and 1,000 AU. The number of operations that would be regulated with between 300 and 1,000 AU is estimated at 10,570 operations (accounting for mixed operations).

Due to continued consolidation and facility closure since 1997, EPA's estimates may overstate the actual number of small businesses in these sectors. In addition, ongoing trends are causing some existing small and medium size operations to expand their inventories to achieve scale economies. Some of the CAFOs considered here as small businesses may no longer be counted as small businesses because they now have higher revenues. Furthermore, some CAFOs may be owned by a larger, vertically integrated firm, and may not be a small business. EPA expects that there are few such operations, but does not have data or information to reliably estimate the number of CAFOs that meet this description.

Under the two-tier structure, EPA estimates also include an additional 500 operations with fewer than 500 AU that may be designated as CAFOs under the proposed regulations over a 10-year period. See Section VI. Of these, 330 operations meet the small business definition: 50 dairies, 200 hog, 40 beef, 20 broiler, and 20 egg laying operations. Under the three-tier structure, EPA estimates that 100 operations with fewer than 300 AU may be designated over ten years, including 50 dairies and 50 hog operations, all of which are small businesses. As these facilities are designated, EPA did not adjust this total to reflect possible mixed animal

operations. Each of these operations are small businesses.

3. Estimated Economic Impacts to Small CAFOs under the Proposed Regulations

EPA conducted a preliminary assessment of the potential impacts to small CAFO businesses based on the results of a costs-to-sales test. This screen test indicated the need for additional analysis to characterize the nature and extent of impacts on small entities. The results of this screening test indicate that about 80 percent (about 9,600) of the estimated number of small businesses directly subject to the rule as CAFOs may incur costs in excess of three percent of sales (evaluated for all operations with more than 500 AU). Compared to the total number of all small animal confinement facilities estimated by EPA (356,000 facilities), operations that are estimated to incur costs in excess of three percent of sales comprise less than two percent of all small businesses in these sectors. The results of this analysis are provided in Section 9 of the Economic Analysis.

Based on the results of this initial assessment, EPA projected that it would likely not certify that the proposal, if promulgated, would not impose a significant economic impact on a substantial number of entities. Therefore, EPA convened a Small Business Advocacy Review Panel and prepared an Initial Regulatory Flexibility Analysis (IRFA) pursuant to Sections 609(b) and 603 of the RFA, respectively. Section XII.G provides more information on EPA's small business outreach and the Panel activities during the development of this rulemaking.

The results of EPA's assessment of the financial impacts of the proposed rule on small entities are as follows. To further examine small businesses effects, EPA used the same approach as that used to evaluate the impact to CAFOs under the proposed regulations described in Section X.D.1. Economic achievability is determined by applying the proposed criteria described in Section X.F.1. These criteria include a sales test and also analysis of post-compliance cash flow and debt-to-asset ratio for an average model CAFO.

Accordingly, if an average model facility is determined to incur economic impacts under regulation that are regarded as ''Affordable'' or ''Moderate,'' then the proposed regulations are considered economically achievable. (''Moderate'' impacts are not expected to result in closure and are considered to be economically achievable by EPA.) If an average operation is determined to incur ''Stress,'' then the proposed regulations are not considered to be economically achievable. ''Affordable'' and ''Moderate'' impacts are associated with positive post-compliance cash flow over a 10-year period and a debt-to-asset ratio not exceeding 40 percent, in conjunction with a sales test result that shows that compliance costs are less than 5 percent of sales (''Affordable'') or between 5 and 10 percent (''Moderate''). ''Stress'' impacts are associated with negative cash flow or if the post-compliance debt-to-asset ratio exceeds 40 percent, or sales test results that show costs equal to or exceeding 10 percent of sales. More detail on this classification scheme is provided in Section X.F.1.

EPA is proposing that the proposed regulations are economically achievable by small businesses in the livestock and poultry sectors. The results of this analysis are presented in Tables 10–18 and 10–19. As defined for this analysis, EPA's analysis indicates that the proposed requirements are economically achievable to all affected small businesses in the beef, veal, heifer, dairy, hog, and egg laying sectors (''Affordable'' and also ''Moderate''). Moderate impacts may be incurred by small businesses in some sectors, but these impacts are not associated with operational change at the CAFO. Under the two-tier structure, EPA expects that there are no small businesses in the turkey sector, as defined for this analysis. Under the three-tier structure, EPA expects that there are an estimated 500 small businesses in the turkey sector (operations with 16,500 to 25,000 birds) (Table 10–17).

EPA's IRFA analysis indicates that the proposed requirements will not result in financial stress to any affected small businesses in the veal, heifer (two-tier only), hog, dairy, egg laying, and turkey sectors. In the beef, heifer (three-tier only), and broiler sectors, however, EPA's analysis indicates that proposed regulations could result in financial stress to some small businesses, making these businesses vulnerable to closure. Overall, these operations comprise about 2 percent of all affected small CAFO businesses. For the two-tier structure, EPA estimates that 10 small beef operations and 150 small broiler operations will experience financial stress. For the three-tier structure, EPA estimates that 40 small beef and heifer operations and 280 small broiler operations will experience financial stress. Small broiler facilities with stress impacts are larger operations with more than 1,000 AU under both tier structures. Small cattle and heifer operations with stress impacts are those that have a ground water link to surface water. This analysis is conducted assuming that no costs are passed through between the CAFO and processor segments of these industries. Based on the results of this analysis, EPA is proposing that the proposed regulations are economically achievable to small businesses in these sectors.

EPA believes that the small business impacts presented are overstated for reasons summarized below. As noted in the Panel Report, EPA believes that the number of small broiler operations is overestimated. In the absence of business level revenue data, EPA estimated the number of ''small businesses'' using the approach described in Sections X.J.1 and X.J.2. Using this approach, virtually all (>99.9 percent) broiler operations are considered ''small'' businesses. This categorization may not accurately portray actual small operations in this sector since it classifies a 10-house broiler operation with 260,000 birds as a small business. Information from industry sources suggests that a two-house broiler operation with roughly 50,000 birds is more appropriately characterized as a small business in this sector. This information is available in the rulemaking record. Therefore, it is likely that the number of small broiler operations may reflect a number of medium and large size broiler operations being considered as small entities. (During the development of the rulemaking, EPA did consult with SBA on the use of an alternative definition for small businesses in all affected sectors based on animal inventory at an operation. Following discussions with SBA, EPA decided not to use this alternative definition. This information is provided in the record.)

EPA believes that the use of a costs-to-sales comparison is a crude measure of impacts on small business in sectors where production contracting is commonly used, such as in the broiler sector (but also in the turkey, egg, and hog sectors, though to a lesser extent). As documented in the Economic Analysis, lower reported operating revenues in the broiler sector reflect the predominance of contract growers in this sector. Contract growers receive a pre-negotiated contract price that is lower than the USDA-reported producer price, thus contributing to lower gross revenues at these operations. Lower producer prices among contract growers is often offset by lower overall production costs at these operations since the affiliated processor firm pays for a substantial portion of the grower's annual variable cash expenses. Inputs supplied by the integrator may include

feeder pigs or chicks, feed, veterinary services and medicines, technical support, and transportation of animals. These variable cash costs comprise a large component of annual operating costs, averaging more than 70 percent of total variable and fixed costs at livestock and poultry operations. The contract grower also faces reduced risk because the integrator guarantees the grower a fixed output price. Because production costs at a contract grower operation are lower than at an independently owned operation, a profit test (costs-to-profit comparison) is a more accurate measure of impacts at grower operations. However, financial data are not available that differentiate between contract grower and independent operations.

EPA's analysis also does not consider a range of potential cost offsets available to most operations. One source of potential cost offset is cost share and technical assistance available to operators for on-site improvements that are available from various state and federal programs, such as the Environmental Quality Incentives Program (EQIP) administered by USDA. These programs specifically target smaller farming operations. Another potential source of cost offset is manure sales, particularly of relatively higher value dry poultry litter. More information on how these potential sources of cost offset would reduce the economic impacts to small operations is described in Section X.F.1 in this document and also in the Economic Analysis. EPA's analysis also does not account for eventual cost passthrough of estimated compliance costs through the marketing chain under longer run market adjustment. Finally, this analysis does not take into account certain non-economic factors that may influence a CAFO's decision to weather the boom and bust cycles that are commonplace in agricultural markets. These other industry-specific factors are discussed in more detail throughout the Economic Analysis.

EPA expects that the proposed regulations will benefit the smallest businesses in these sectors since it may create a comparative advantage for smaller operations (less than 500 AU), especially those operations which are not subject to the regulations. Except for the few AFOs which are designated as CAFOs, these operations will not incur costs associated with the proposed requirements but could benefit from eventual higher producer prices as these markets adjust to higher production costs in the longer term.

As detailed in Sections XII.G and XIII.B of this document, EPA convened a Small Business Advocacy Review Panel during the development of this rule. As described in the Panel Report, EPA considered certain regulatory alternatives to provide relief for small businesses. Some of these alternatives are discussed in other sections of this document, including Section VII and Section VIII. These alternative options are summarized in the following section and are described in more detail in Section 9 of the Economic Analysis.

TABLE 10–18.—RESULTS OF EPA'S SMALL BUSINESS ANALYSIS UNDER THE BAT OPTION/SCENARIO 4A

Sector	Number of small CAFOs	Zero cost passthrough					
		(Number of operations			(% Affected operations)		
		Affordable	Moderate	Stress	Affordable	Moderate	Stress
Fed Cattle	1,390	1,130	250	10	81	18	1
Veal	90	90	0	0	100	0	0
Heifer	800	680	120	0	85	15	0
Dairy	50	40	10	0	80	20	0
Hogs	300	300	0	0	100	0	0
Broilers	9,470	1,860	7,460	150	20	79	2
Layers	200	200	0	0	100	0	0
Turkeys	0	0	0	0	NA	NA	NA
Total	10,550	4,300	7,840	160	41	74	2

Source: USEPA. Impact estimates shown include impacts to designated operations. Option/Scenario definitions provided in Table 10–2. Category definitions (''Affordable,'' ''Moderate'' and ''Stress'') are provided in Section X.F.1. Numbers may not add due to rounding. NA = Not Applicable.

[1] ''Total'' does not adjust for operations with mixed animal types, for comparison purposes, to avoid understating costs at operations with more than one animal type that may incur costs to comply with the proposed requirements for each type of animal that is raised on-site. The number of CAFOs shown includes expected defined CAFOs only and excludes designated facilities.

TABLE 10–19.—RESULTS OF EPA'S SMALL BUSINESS ANALYSIS UNDER THE BAT OPTION/SCENARIO 3

Sector	Number of small CAFOs	Zero cost passthrough					
		(Number of operations			(% Affected operations)		
		Affordable	Moderate	Stress	Affordable	Moderate	Stress
Fed Cattle	1,490	1,100	380	10	74	26	1
Veal	140	140	0	0	100	0	0
Heifer	980	800	150	30	82	15	3
Dairy	50	40	10	0	80	20	0
Hogs	300	300	0	0	100	0	0
Broilers	13,410	1,910	11,220	280	14	84	2
Layers	590	590	0	0	100	0	0
Turkeys	500	460	40	0	92	8	0

TABLE 10–19.—RESULTS OF EPA'S SMALL BUSINESS ANALYSIS UNDER THE BAT OPTION/SCENARIO 3—Continued

Sector	Number of small CAFOs	Zero cost passthrough					
		(Number of operations			(% Affected operations)		
		Affordable	Moderate	Stress	Affordable	Moderate	Stress
Total	14,630	5,340	11,800	320	37	81	2

Source: USEPA. Impact estimates shown include impacts to designated operations. Option/Scenario definitions provided in Table 10–2. Category definitions (''Affordable,'' ''Moderate'' and ''Stress'') are provided in Section X.F.1. Numbers may not add due to rounding. NA = Not Applicable.

[1] ''Total'' does not adjust for operations with mixed animal types, for comparison purposes, to avoid understating costs at operations with more than one animal type that may incur costs to comply with the proposed requirements for each type of animal that is raised on-site. The number of CAFOs shown includes expected defined CAFOs only and excludes designated facilities.

4. Regulatory Relief to Small Livestock and Poultry Businesses

EPA proposes to focus the regulatory revisions in this proposal on the largest operations, which present the greatest risk of causing environmental harm, and in so doing, has minimized the effects of the proposed regulations on small livestock and poultry operations. First, EPA is proposing to establish a two-tier structure with a 500 AU threshold. Unlike the current regulations, under which some operations with 300 to 500 AU are defined as CAFOs, operations of this size under the revised regulations would be CAFOs only by designation. Second, EPA is proposing to eliminate the ''mixed'' animal calculation for operations with more than a single animal type for determining which AFOs are CAFOs. Third, EPA is proposing to raise the size standard for defining egg laying operations as CAFOs.

EPA estimates that under the co-proposed alternatives, between 64 percent (two-tier) and 72 percent (three-tier) of all CAFO manure would be covered by the regulation. (See Section IV.A of this preamble.) Under the two-tier structure, the inclusion of all operations with more than 300 AU instead of operations with more than 500 AU, the CAFO definition would result in 13,800 additional operations being regulated, along with an additional 8 percent of all manure. An estimated 80 percent of these additional 13,800 CAFOs are small businesses (about 10,870 CAFOs). EPA estimates that by not extending the regulatory definition to operations with between 300 and 500 AU, these 10,870 small businesses will not be defined as CAFOs and will therefore not be subject to the proposed regulations. The additional costs of extending the regulations to these small CAFO businesses is estimated at almost $150 million across all sectors. The difference in costs between the two-tier and the three-tier structures may be approximated by comparing the estimated costs for these regulatory options, which are shown in Table 10–5. Also, under the two-tier structure, EPA is proposing to raise the size standard for defining egg laying operations as CAFOs. This alternative would remove from the CAFO definition egg operations with between 30,000 and 50,000 laying hens (or 75,000 hens) that under the current rules are defined as CAFOs, if they utilize a liquid manure management system.

In addition, under both co-proposed alternatives, EPA is proposing to exclude mixed operations with more than a single animal type. The Agency determined that the inclusion of these operations would disproportionately burden small businesses while resulting in little additional environmental benefit. Since most mixed operations tend to be smaller in size, this exclusion represents important accommodations for small businesses. If certain of these smaller operations are determined to be discharging to waters of the U.S., States can later designate them as CAFOs and subject them to the regulations.

XI. What are the Environmental Benefits of the Proposed Revisions?

A. Non-Water Quality Environmental Impacts

The regulatory options developed for this proposed rule are intended to ensure the protection of surface water in and around animal feeding operations. However, one or more of the requirements included in these options may also have an impact on the amount and form of compounds released to air, as well as the energy that is required to operate the feedlot. Under sections 304(b) and 306 of the CWA, EPA is to consider the non-water quality environmental impacts (NWQI) when setting effluent limitations guidelines and standards. This section describes the methodology EPA used to estimate the NWQI for each of the options considered for this proposed rule. These non-water quality environmental impacts include:

- Air emissions from the feedlot operation, including animal housing and animal waste storage and treatment areas;
- Air emissions from land application activities;
- Air emissions from vehicles, including the off-site transport of waste and on-site composting operations; and
- Energy impacts from land application activities and the use of digesters.

For each regulatory option, EPA estimated the potential for new water pollution control requirements to cause cross-media pollutant transfers. Consistent with the approach used to estimate compliance costs, EPA used a model-facility approach to estimate NWQIs and to define baseline conditions. Industry-level non-water quality impacts for each animal sector (i.e., beef, dairy, swine, and poultry) were then estimated by multiplying the model farm impacts by the number of facilities represented by that model farm. These results are presented in Tables 11–1 through 11–4 for the population of operations defined as CAFOs under the two-tier structure (operations with more than 500 AU) and Tables 11–5 through 11–8 for the population defined as CAFOs under the three tier structure. For details on the derivation of the model farms, including definitions of geographic location, method of determining model farm populations, and data on waste generation, see the Technical Development Document.

1. Sources of Air Emissions

Animal feeding operations generate various types of animal wastes, including manure (feces and urine), waste feed, water, bedding, dust, and wastewater. Air emissions are generated from the decomposition of these wastes from the point of generation through the management and treatment of these wastes on site. The rate of generation of these emissions varies based on a number of operational variables (e.g., animal species, type of housing, waste

management system), as well as weather conditions (temperature, humidity, wind, time of release). A fraction of the air emissions from AFOs are subsequently redeposited on land or in surface waters. This atmospheric redeposition in turn can be a source for water quality impacts.

a. *Air Emissions from the Feedlot Operation.* Animal housing and manure management systems can be a significant source of air emissions. Little data exist on these releases to allow a complete analysis of all possible compounds. For this proposed rule, EPA has focused on the release of greenhouse gases (methane, carbon dioxide, and nitrous oxide), ammonia, and certain criteria air pollutants (carbon monoxide, nitrogen oxides, volatile organic compounds, and particulate matter).

i. *Greenhouse Gas Emissions from Manure Management Systems.* Manure management systems, including animal housing, produce methane (CH_4), carbon dioxide (CO_2), and nitrous oxide (N_2O) emissions. Methane and carbon dioxide are produced by the anaerobic decomposition of manure. Nitrous oxide is produced as part of the agricultural nitrogen cycle through the denitrification of the organic nitrogen in livestock manure and urine. Greenhouse gas emissions for methane and nitrous oxide were estimated for this proposed rule based on methodologies previously used by EPA's Office of Air and Radiation. Emission estimates for carbon dioxide are based on the relationship of carbon dioxide generation compared to methane generation.

Methane. Methane production is directly related to the quantity of waste, the type of waste management system used, and the temperature and moisture of the waste. Some of the regulatory options evaluated for animal feeding operations are based on the use of different waste management systems which may increase or decrease methane emissions from animal operations. In general, manure that is handled as a liquid or in anaerobic management systems tends to produce more methane, while manure that is handled as a solid or in aerobic management systems produces little methane. The methane producing capacity of animal waste is related to the maximum quantity of methane that can be produced per kilogram of volatile solids. Values for the methane producing capacity are available from literature and are based on animal diet. EPA estimated methane emissions for each type of waste management system included in the cost models. These values vary by animal type, geographic region (the methane conversion factor is a function of the mean ambient temperature), and type of waste management system (e.g., anaerobic lagoon, composting, drylot, stacked solids, or runoff storage pond).

Methane is also produced from the digestive processes of ruminant livestock due to enteric fermentation. Certain animal populations, such as beef cattle on feedlots, tend to produce more methane because of higher energy diets that produce manure with a high methane-producing capacity. However, since the proposed regulatory options do not impose requirements forcing CAFOs to use specific feeding strategies, potential impacts on enteric fermentation methane emissions are speculative and were not estimated.

Carbon Dioxide. Carbon dioxide is a naturally occurring greenhouse gas and is continually emitted to and removed from the atmosphere. Certain human activities, such as fossil fuel burning, cause additional quantities of carbon dioxide to be emitted to the atmosphere. In the case of feedlot operations, the anaerobic degradation of manure results not only in methane emissions, but also carbon dioxide emissions. These carbon dioxide emissions due to anaerobic degradation were estimated for each regulatory option. In addition, under Option 6, large dairies and swine operations would install and operate anaerobic digestion systems with energy recovery units. The biogas produced in the digester is burned in an engine to recover energy. EPA's emission estimates for Option 6 include the carbon dioxide produced during this combustion process.

Nitrous Oxide. The emission of nitrous oxide from manure management systems is based on the nitrogen content of the manure, as well as the length of time the manure is stored and the specific type of system used. In general, manure that is handled as a liquid tends to produce less nitrous oxide than manure that is handled as a solid. Some of the regulatory options evaluated for animal feeding operations are based on the use of waste management systems which may increase nitrous oxide emissions from animal operations. Values for total Kjeldahl nitrogen (TKN), a measure of organic nitrogen plus ammonia nitrogen, vary by animal type and are typically available in the literature for animal waste. EPA estimated nitrous oxide emissions by adjusting these literature values with an emission factor that accounts for the varying degree of nitrous oxide production, based on the type of manure management system.

ii. *Ammonia Emissions and Other Nitrogen Losses from Housing and Manure Management Systems.* Much of the nitrogen emitted from animal feeding operations is in the form of ammonia. Ammonia is an important component responsible for acidification and overnutrification of the environment. The loss of ammonia occurs at both the point of generation of manure, typically from urine, as well as during the storage and treatment of animal waste. As the pH of a system rises above 7, nitrogen in the form of ammonium is transformed into ammonia. A number of variables affect the volatilization of ammonia from animal waste, including the method in which the waste is stored, transported, and treated on site and the environmental conditions present (e.g., temperature, pH, wind).

Animals at the feedlot operation may be housed in a number of different ways that have an impact on the type and amount of nitrogen emissions that will occur. Some animals are housed in traditional confined housing (e.g., tie stall barns, freestall barns), while others are housed in outdoor areas (e.g., drylots, paddocks). Studies have shown that the type of housing used has a great effect on the emission of ammonia. Management of waste within the housing area also affects emissions (e.g., litter system, deep pit, freestall).

Anaerobic lagoons and waste storage ponds are a major component of the waste management systems. EPA has estimated volatilization of total nitrogen and ammonia from lagoons and ponds based on emission factors published in the scientific literature.

iii. *Criteria Air Emissions from Energy Recovery Systems.* Option 6 requires the implementation of anaerobic digestion systems with energy recovery for large dairy and swine operations. The operation of the digestion system greatly reduces the emission of methane through the capture of the biogas. However, the use of the biogas in an energy recovery system does generate certain criteria air pollutants when burned for fuel. Literature values for emission factors for carbon monoxide (CO), oxides of nitrogen (NO_X), and volatile organic compounds (VOCs) were used to estimate releases of criteria air pollutants.

b. *Air Emissions from Land Application Activities.* Animal feeding operations generate air emissions from the land application of animal waste on cropland. Air emissions are primarily generated from the volatilization of ammonia at the point the material is applied to land. Additional emissions of nitrous oxide are liberated from

agricultural soils when nitrogen applied to the soil undergoes nitrification and denitrification. Loss through denitrification is dependent on the oxygen levels of the soil to which manure is applied. Low oxygen levels, resulting from wet, compacted, or warm soil, increase the amount of nitrate-nitrogen released to the air as nitrogen gas or nitrous oxide. The analysis of air emissions from land application activities for this proposed rule focused on the volatilization of nitrogen as ammonia because the emission of other constituents is expected to be less significant.

The amount of nitrogen released to the environment from the application of animal waste is affected by the rate and method in which it is applied, the quantity of material applied, and site-specific factors such as air temperature, wind speed, and soil pH. There is insufficient data to quantify the effect of site-specific factors.

Since regulatory options in this proposed rule do not dictate particular application methods, EPA assumed that the application methods used by animal feeding operations will not significantly change from baseline.

Because EPA expects application methods to remain stable, EPA assumed that only the quantity of waste applied to cropland will change. On-site nitrogen volatilization will decrease as the quantity of waste applied to cropland decreases. The reductions of nitrogen volatilization will be the result of reductions in the total amount of manure applied on site. However, when both on-site and off-site nitrogen volatilization are considered, total nitrogen volatilization from manure is expected to remain constant. The movement of waste off-site changes the location of the nitrogen releases but not the quantity released. On-site, however, the volatilization rate will decrease, reflecting the decrease in the quantity of applied waste.

EPA used the same assumptions that were used to estimate compliance costs for land application of animal waste in order to estimate the change in air emissions from the application of nitrogen under baseline conditions and for each regulatory option. The cost methodology defines three types of animal feeding operations: Category 1 facilities currently have sufficient land to apply all manure on site; Category 2 facilities currently do not have enough land to apply all manure on site; and Category 3 facilities currently apply no manure on site (this manure is already being spread offsite). Neither Category 1 nor Category 3 facilities will show a change in nitrogen emission rates from the land application of animal manure under the proposed regulatory options. However, Category 2 facilities will be required to apply their waste at the agricultural rate under the regulatory options, thus reducing the amount of manure applied on site and subsequently reducing air emissions from on-site land application.

Under a phosphorus-based application scenario, facilities will have to apply supplemental nitrogen fertilizer to meet crop nutrient needs. The cost model assumes facilities will apply commercial ammonium nitrate or urea. The application of commercial fertilizer represents an increase in applied nutrients on site. While losses from applied commercial nitrogen are expected to be less than those from applied manure, data from Ohio State Extension states that both of these fertilizers can experience losses through denitrification if placed on wet or compacted soils. There is also a possibility that urea will volatilize if it is dry for several days after soil application. Ammonium nitrate fertilizer (when injected) is less likely to volatilize because it quickly converts to nitrate nitrogen which will not volatilize.

EPA estimated a ''worst-case scenario'' for ammonia emissions due to commercial fertilizer application based on a 35% loss of applied nitrogen.

c. *Air Emissions from Vehicles.* i. *Off-Site Transportation.* All options are expected to result in increasing the amount of manure hauled off-site, at least for some operations. Consistent with the cost model, EPA has grouped operations into three possible transportation categories. Category 1 facilities currently land apply all manure on site and Category 3 facilities currently transport all manure off site. Neither Category 1 nor Category 3 facilities require additional transportation of manure and will not have an increase in criteria air emissions. Category 2 facilities do not have enough land to apply all waste on site and do not currently transport waste. These facilities are expected to transport manure off site and therefore will have an increase in the amount of criteria air pollutants generated by the facility.

Hauling emissions estimates are based on calculations of the annual amount of waste generated, the annual number of miles traveled, and truck sizes. The number of trucks, number of trips per truck, the amount of waste and transportation distance are all calculated within the cost model. Vehicle emissions are calculated based on emission factors for diesel-fueled vehicles presented in ''Compilation of Air Pollution Emission Factors'' (AP–42). Estimates were calculated for volatile organic compounds, nitrogen oxides, particulate matter, and carbon monoxide.

ii. *On-Site Composting Activities.* Farm equipment used for on-site composting activities also affect the generation of air emissions, although composting of waste may also result in a reduction in transportation air emissions. While composting waste prior to hauling offsite can increase the marketability of the manure and may decrease hauling costs per ton of waste for some operations, not all operations can be expected to realize such benefits. Under Option 5, beef and dairy operations would be required to compost their solid manure. The criteria air emissions from on-site composting of manure were estimated for beef and dairy operations under Option 5. The source of criteria air emissions from composting are tractors and associated windrow-turning equipment.

2. Summary of Air Emission Impacts

Option 1: Emissions of methane and carbon dioxide from beef and dairy operations decrease under Option 1 due to the addition of solids separation in the waste management system. The separated solids are stockpiled rather than held in waste storage ponds or anaerobic lagoons. Anaerobic conditions, and the potential of the volatile solids to convert to methane, decrease using this drier method of handling the waste. However, this method also results in greater conversion of nitrogen to nitrous oxide. An increase in nitrous oxide emissions from dairies occurs for this reason. Greenhouse gas emissions from dry poultry operations (broilers, turkeys, and dry layers) do not change under Option 1 since no change to the waste handling practices are expected. These operations are already handling the waste as a dry material. Although indoor storage of poultry litter is included in the options, it is not expected to significantly alter the air emissions from the litter. Emissions of greenhouse gases from swine and wet poultry operations also do not change since no change to the waste handling practices are expected.

Ammonia emissions occur primarily from liquid waste storage areas, including ponds and lagoons. Under Option 1, all facilities are required to contain surface runoff from the feedlot, thereby increasing ammonia emissions from smaller beef and dairy CAFOs that do not currently have runoff control ponds or lagoons. Ammonia emissions

for the poultry and swine sectors are not expected to change under Option 1.

Option 1 requires the application of animal waste to cropland at agronomic rates for nitrogen. Animal feeding operations that have excess nitrogen for their crops will need to transport their waste to another location. The generation of criteria pollutants for all animal sectors are expected to increase from baseline to Option 1 due to the additional transportation of waste off-site.

Options 2–4 and 7: No change in emissions of methane, carbon dioxide, or nitrous oxide occurs for all sectors relative to Option 1 because no significant changes in waste management are anticipated. Likewise, no large changes are expected for ammonia emissions.

These options require the application of animal waste to cropland at agronomic rates for phosphorus. Animal feeding operations that have excess phosphorus for their crops will need to transport their waste to another location. The generation of criteria pollutants are expected to increase from Option 1 to these options because more waste will need to be transported off site to meet agronomic rates for phosphorus.

Option 5A: Option 5A does not apply to the beef and dairy sectors. Emissions of greenhouse gases at swine operations significantly decrease under Option 5A, due to covering lagoons. The swine operations are expected to flare the gas that is generated in the lagoon. The methane will be converted, although carbon dioxide emissions will increase. In addition, the emissions of NO_X and SO_X increase because of the flaring of biogas collected from the covered lagoon.

On-site ammonia emissions at swine operations will decrease because the lagoon cover prevents the ammonia from leaving solution. Ammonia in the effluent from the covered lagoon will volatilize, however, soon after it is exposed to air.

Option 5B: Emissions of greenhouse gases from beef and dairy operations increase under Option 5B (i.e., mandated technology of composting), relative to Options 1 and 2. Compost operations include the addition of organic material to the waste pile to aid in the decomposition of the waste. This additional material also decomposes and contributes to increased methane emissions compared to other options. In addition, compost operations liberate more methane than stockpiles because the windrows are turned regularly. Stockpiles tend to form outer crusts that reduce the potential for air emissions to occur.

Emissions of greenhouse gases for swine operations under Option 5B are less than Option 2 due to the conversion of liquid manure handling systems (e.g., flush lagoons) to dry manure handling systems. Dry manure generates less methane than liquid systems. However, the emissions are higher than either Options 5A or 6, which allow liquid manure systems, but include destruction of the biogas generated from those systems.

Ammonia emissions at beef and dairy operations are expected to increase. During composting operations, the aeration of the compost pile liberates nitrogen in the form of ammonia. Ammonia emissions at swine operations are expected to decrease compared to Option 2, because of liquid manure systems converting to dry operations.

Option 5B generates the least criteria air pollutants compared to any other option for beef operations. Although composting operations include the operation of turning equipment which uses fuel and generates additional tractor air emissions, the process reduces the overall volume of waste to be transported. However, for dairy, additional organic material is added to the compost pile, which results in slightly higher transportation emissions than Option 2. Option 5B emissions of criteria pollutants for poultry operations are equal to the emissions for Options 2–4 and 7, since there is no difference in the amount of waste transported off site. The emissions from swine operations are significantly lower than Option 2 because the conversion of flush operations to dry housing significantly decreases the volume of waste to be transported off site.

Option 6: Relative to Option 2, only the dairy and swine sectors see any changes in air emissions. Emissions of methane from swine and dairy waste under Option 6 significantly decrease due to the addition of the anaerobic digester. A significant portion of the methane generated is collected as biogas and converted to energy. Drylot areas at dairies, however, will continue to generate methane that is uncollected. Carbon dioxide emissions significantly increase as methane is converted during the combustion process.

Although waste at large swine and dairy CAFOs will be digested, no significant changes to ammonia emissions are expected. The ammonia nitrogen, which is highly soluble, remains in solution in the digester. When the digester effluent is stored in an open lagoon, the ammonia will then be released.

Emissions of criteria pollutants from swine and dairy operations increase due to the addition of anaerobic digestion for large dairy operations. The digester collects biogas, which is subsequently combusted and converted into VOCs, NO_X, and CO. Hydrogen sulfide contained in swine waste will be converted to Sox.

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Table 11-1. Air Emissions and Energy Use for Beef (Including Heifer) Operations Under the Two-Tier Structure (≥500 AU)

NWQI	Baseline	Regulatory Option							
		Option 1	Option 2	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7
Air Emissions									
Methane (CH_4) (Gg/yr)	72	69	69	69	69		93	69	69
Carbon Dioxide (CO_2) (Gg/yr)	31	30	30	30	30		40	30	30
Nitrous Oxide (N_2O) (Gg/yr)	34	34	34	34	34		49	34	34
Ammonia (NH_3) (1000 Tons/yr)	581	582	582	582	582		902	582	568
Volatile Organic Compounds (VOCs) (Tons/yr)	NC	Baseline + 235	Baseline + 284	Baseline + 284	Baseline + 284		Baseline + 75	Baseline + 284	Baseline + 284
Nitrogen Oxides (NOx) (Tons/yr)	NC	Baseline + 905	Baseline + 1,091	Baseline + 1,091	Baseline + 1,091		Baseline + 291	Baseline + 1,091	Baseline + 1,091
Particulate Matter (PM) (Tons/yr)	NC	Baseline + 18	Baseline + 22	Baseline + 22	Baseline + 22		Baseline + 6	Baseline + 22	Baseline + 22
Carbon Monoxide (CO) (Tons/yr)	NC	Baseline + 2,800	Baseline + 3,400	Baseline + 3,400	Baseline + 3,400		Baseline + 900	Baseline + 3,400	Baseline + 3,400
Energy Usage									
Electricity Usage (1000 kW-hr/yr)	NC	Baseline + 11,082	Baseline + 45,109	Baseline + 45,109	Baseline + 45,109		Baseline + 45,109	Baseline + 45,109	Baseline + 45,109
Fuel Usage (1000 gallons/yr)	NC	Baseline + 1,917	Baseline + 2,311	Baseline + 2,311	Baseline + 2,311		Baseline + 420	Baseline + 2,311	Baseline + 2,311

Table 11-2. Air Emissions and Energy Use for Dairy Operations Under the Two-Tier Structure (≥500 AU)

NWQI	Baseline	Regulatory Option							
		Option 1	Option 2	Option 3	Option 4	Option 5A	Option 5B	Option 6	Option 7
Air Emissions									
Methane (CH_4) (Gg/yr)	216	138	138	138	138		163	11	138
Carbon Dioxide (CO_2) (Gg/yr)	93	59	59	59	59		70	1,289	59
Nitrous Oxide (N_2O) (Gg/yr)	4	8	8	8	8		28	8	8
Ammonia (NH_3) (1000 Tons/yr)	217	220	220	220	220		257	207	218
Volatile Organic Compounds (VOCs) (Tons/yr)	NC	Baseline + 222	Baseline + 201	Baseline + 201	Baseline + 201		Baseline + 213	Baseline + 262	Baseline + 201
Nitrogen Oxides (NOx) (Tons/yr)	NC	Baseline + 855	Baseline + 772	Baseline + 772	Baseline + 772		Baseline + 821	Baseline + 4,454	Baseline + 772
Particulate Matter (PM) (Tons/yr)	NC	Baseline + 17	Baseline + 15	Baseline + 15	Baseline + 15		Baseline + 17	Baseline + 15	Baseline + 15
Carbon Monoxide (CO) (Tons/yr)	NC	Baseline + 2,700	Baseline + 2,400	Baseline + 2,400	Baseline + 2,400		Baseline + 2,500	Baseline + 2,900	Baseline + 2,400
Energy Usage									
Electricity Usage (1000 kW-hr/yr)	NC	Baseline + 8,759	Baseline + 9,899	Baseline + 9,899	Baseline + 9,899		Baseline + 9,899	Baseline + (1,139,200)	Baseline + 9,899
Fuel Usage (1000 Gallons/yr)	NC	Baseline + 1,811	Baseline + 1,635	Baseline + 1,635	Baseline + 1,635		Baseline + 1,646	Baseline + 1,605	Baseline + 1,635